Montana Outdoors

May/June 1979
One Dollar

Montana Outdoors
May/June 1979, Vol. 10, No. 3
(USPS 360 280)

2 **High Water: The Fisherman's Friend**
The sound of rushing water doesn't have to spell disaster for an early spring fishing trip. by John J. Gaffney

6 **The Red Fox: A Coat of Many Colors**
Farmers, hunters and trappers view the red fox from different perspectives. by Frank Gjersing

8 **The Land Where the Rivers Join**
Dick Ellis unravels the fascinating history of the area where the Missouri Headwaters State Park was established

13 **The Catchall**
"Neighboring Anglers Catch Record Fish, Too," by Mike Aderhold, plus other items

16 **Contributors**

17 **Danny On's Legacy Will Live On**
A collection of Danny's photographs, with a tribute by Louis Kis and others

22 **Marshland Concerto**
A marsh awakens to the yearly spring clangor of returning waterfowl. by Ken Walcheck

25 **Dear F&G**

26 **Editorials**

29 **The Rocky Mountain Wood Tick: Beware Its Bite**
If you frequent tick-infested areas, follow some simple precautions and familiarize yourself with initial symptoms of tick-related diseases. by Dr. Willy Burgdorfer

32 **Floating Classroom on the Magic Missouri**
A unique classroom for Northern Montana College's challenging six-day course. by Ken Walcheck

37 **Pipeline Breaks: Oil and Wildlife Don't Mix**
The impacts of petroleum products on aquatic life—including mammals and waterfowl—are substantial. by Ken Knudson

THE COVER: No matter if the red fox is viewed as friend or foe, it does indeed have "A Coat of Many Colors," as Frank Gjersing points out in his article, beginning on page 6 (front cover photo: Danny On). Pipeline breaks cause oil spills such as the one pictured on the back cover (F&G photo: Al Wipperman). When other methods won't work, clean-up procedures include spreading straw (which absorbs the oil) and then burning the straw. This spill occurred in 1972 in a backwater slough on the Clark Fork of the Columbia near Turah. For more information on the reasons why "Oil and Wildlife Don't Mix," turn to Ken Knudson's article on page 37.

Thomas L. Judge/*Governor*
State of Montana

Joseph J. Klabunde/*Chairman*
Fish and Game Commission

Commission Members:
Spencer S. Hegstad/*Vice Chairman*
Alfred L. Bishop
Arthur C. Hagenston
Earl L. Sherron

Robert F. Wambach/*Director*
Department of Fish and Game

Fletcher E. Newby/*Deputy Director*
Orville W. Lewis/*Associate Director*
Vern Craig/*Chief, Conservation Education Bureau*

Dave Books/*Editor*
Kay Ellerhoff/*Associate Editor*
Donita Sexton/*Art Director*
Sheila Bradt/*Circulation*

Montana Outdoors, the official publication of the Montana Department of Fish and Game, is published six times each year (January, March, May, July, September and November.) Contributions (manuscripts or illustrations) are welcome with the understanding that the department or the editor cannot be responsible for loss or damage. All contributions will be published at the discretion of the editor. Subscription rates are $5 for one year, $9.50 for two years, $13 for three years. (Please add $2 per year for foreign subscriptions, excluding Canada.) Individual copies are available at newsstands and regional department offices. Price per copy is $1. Although *Montana Outdoors* is copyrighted, permission to reprint articles is available by writing our office or phoning us at 406-449-2474. All correspondence should be addressed: *Montana Outdoors*, Department of Fish and Game, 1420 E. Sixth; Helena, MT 59601. © Montana Department of Fish and Game 1979. All rights reserved

Postmaster: Second class postage paid at Helena, MT 59601 and additional mailing offices.

The Director's Column

In 1973, the Montana Department of Fish and Game established what has come to be known as the "five-year preference system." The intention of this policy was to give priority in the moose, bighorn sheep and mountain goat drawings to people who had unsuccessfully applied for these permits for five or more consecutive years. Adopted at the urging of Montana's sportsmen, the preference system was designed to reward the perseverance of dedicated hunters.

Most hunters assumed that, following five years of unsuccessful application, they would soon be in line for a permit. Since 1973, however, several events have conspired to change this rosy outlook. The most significant has been the dramatic increase in the number of hunters applying for moose, sheep and goat permits. For example, in 1973, the department received 13,007 applications for the 798 available moose permits. But by 1978, the number of applications had risen to 19,329, and the number of available permits had dropped to 589. For all special licenses in 1978, the department received 113,490 applications—an increase of nearly 21% over 1977.

Another factor that has affected the efficient functioning of the preference system has been a change in the method of record-keeping. Prior to 1976, hunters were required to keep their unsuccessful application notices as proof of eligibility for five-year preference. Since 1976, however, the department's computer has maintained these records for the sportsmen, resulting in a sharp rise in the number of people qualifying for preference.

Although it's difficult to predict human behavior, it seems logical to conclude that the number of people applying for special licenses—and preference—will continue to increase, at least in the near future. Within the next several years, as many as 14,000 hunters with five or more years of preference could be competing for the approximately 600 moose permits available each year. What it all boils down to is this: Hunters have no automatic assurance of receiving a permit shortly after reaching five-year preference—it may be *many* years before they receive a permit. Young hunters and others just entering the drawings can look forward to an even longer wait, since by the time they reach five-year preference status, others will have reached six and seven-year status, etc.

When it became obvious that the preference system had some potential problems, the department began an exhaustive evaluation of the situation. Soliciting input from hunters was central to this evaluation. In January 1979, the preference system was thoroughly explained and debated at eight public hearings conducted across the state. More than 200 hunters participated in the discussions, and nearly 100 letters commenting on the system were received in Helena. In addition, more than 1,800 questionnaires were received from hunters all over the state with comments, both pro and con, concerning the preference system.

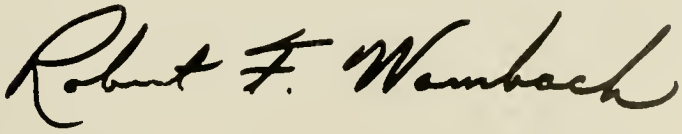
What were the results? A slight majority of hunters (55%) expressed a desire to retain some sort of preference system in the awarding of moose, sheep and goat permits. These people prefer waiting many years, provided they have a reasonable assurance of receiving a permit *someday*, to facing poor odds each year with no guarantee of success. Many people also felt that by going back to the old system of requiring hunters to keep their own records (unsuccessful notices), the number of people reaching five-year preference status would be substantially reduced, thus favoring the dedicated hunters and solving at least part of the "numbers" problem.

Input was also solicited on a department recommendation to allow only one hunting district choice each for moose, sheep and goat. While this recommendation has no bearing on the preference system, it will simplify the drawing procedure, and most hunters supported it.

As a result of this public involvement, the Fish and Game Commission at its February 1979 meeting voted to retain the preference system with the following modifications: In 1979, the Department of Fish and Game will confirm for the last time the number of years of preference each hunter has accumulated. It will be up to each hunter to save his or her own unsuccessful notices and, beginning in 1980, mail them to the department when applying for preference on moose, sheep and goat. In addition, only one hunting district choice will be available in the drawings for each of these species.

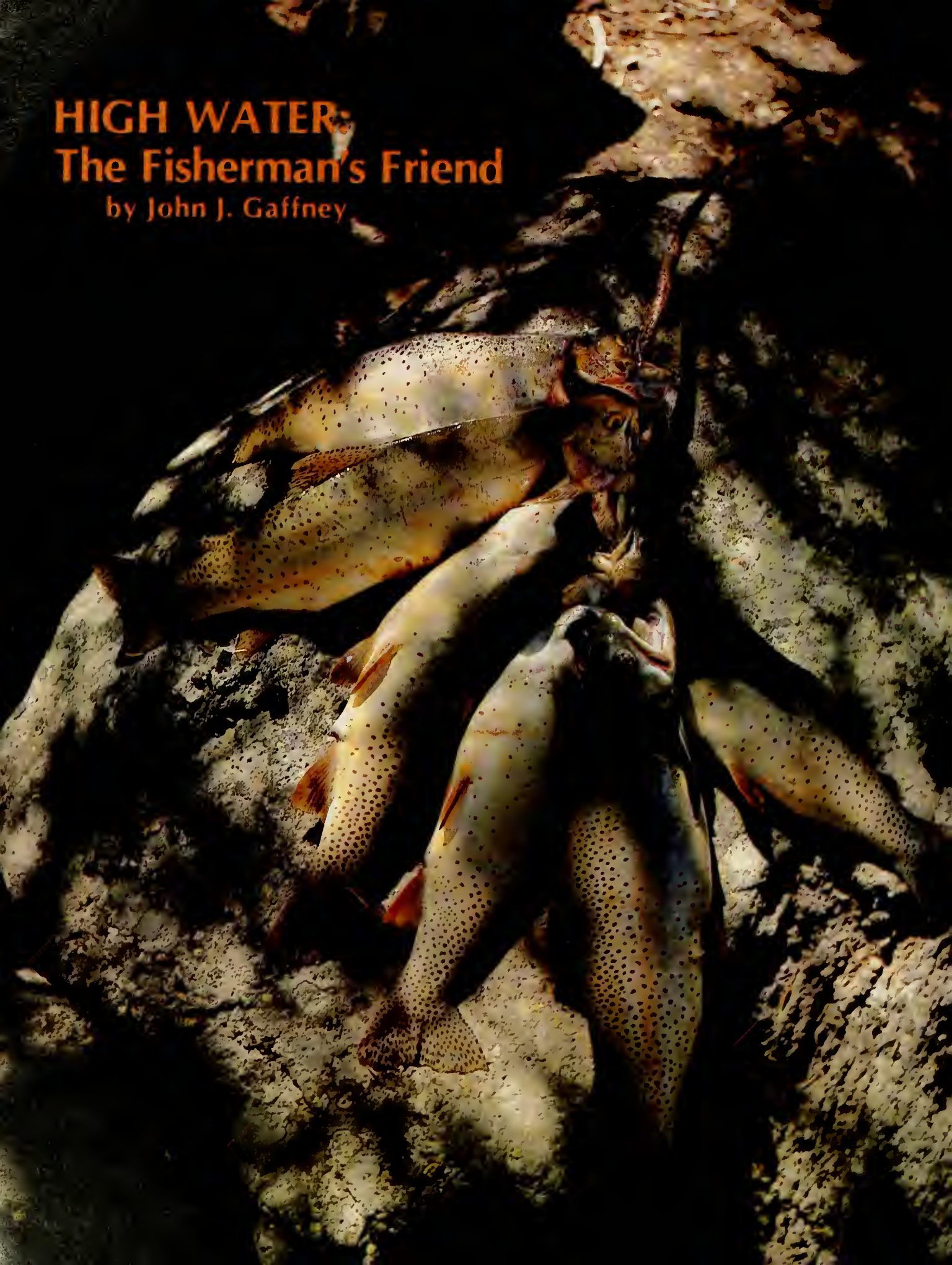
The department will continue to closely monitor the preference system and will investigate additional methods of improving it. Several items will be evaluated, including (1) the possibility of splitting the available permits so that some are awarded under the preference system and some under the old system of random chance and (2) the possibility of going back to the old "envelope" system, where the hunter files, for each species, a separate application envelope that remains unopened unless he is successful.

Both sportsmen and department employees spent a great deal of time and effort on the recent evaluation of the preference system. As a result, many sportsmen now have a better understanding and more realistic expectations of the system, and the department has a better grasp of the desires of sportsmen. We feel the changes which have been adopted as a result of the evaluation will increase hunters' satisfaction with the moose, sheep and goat drawings in years to come.



HIGH WATER: The Fisherman's Friend

by John J. Gaffney



SHORTLY AFTER DAYLIGHT on the first Saturday in May, two fishermen eased their pickup camper into the fishing access that would be their headquarters for the next two days. A dense growth of brush and trees hid the stream from view, but the sound of rushing water came through over the engine noise. They parked the truck and slid from the cab to enjoy the sights and sounds of dawn on a trout stream.

During the long winter, Joe and his friend Al had planned this weekend fishing trip to their favorite trout stream. As April gave way to May, the two fishermen were confident that snowmelt had not progressed to the point where the stream would be high and turbid. The light rain shower the previous Thursday certainly wouldn't have increased stream flow enough to bring on high water. The stream would be up a little from the low winter flows, and should offer some excellent fishing for browns and rainbows, whose appetites would be increasing with rising spring water temperatures.

As they stepped from the truck, Joe's attention focused on the sound of the rushing stream. "Are my ears playing tricks or is the stream up?" he asked, hoping for some reassurance from his partner.

"I'm afraid it isn't your ears—let's take a look," replied Al, and they hurried down the trail to check the stream.

Before they reached the stream bank, they knew what they would see. Instead of the clear water they had hoped for, they were staring at a roily, turbid stream. Apparently, the weather front that caused a light shower in their home town had dropped a heavy, warm rain in this drainage, advancing the snowmelt. The disappointed anglers decided to return to the camper for a cup of coffee while they planned a new strategy.

The possibilities of catching fish under these conditions seemed remote, but Joe and Al decided to rig their tackle and give it a try. Armed with fly rods, wet flies and a supply of night crawlers, they separated to try different stretches of stream.

Joe walked upstream to a familiar undercut bank that always produced a strike or two. He worked the undercut carefully for 30 minutes with flies and bait without success. Water velocity and turbulence had changed the character of the stream, and Joe had difficulty presenting the lures as he would with the water lower. A few other familiar spots were equally unproductive, so he finally gave up and returned to the camper.

Al returned shortly with similar complaints of high water and unfishable runs. The anglers spent the next hour drinking coffee and

Trout can be taken during high water (above) with methods that differ only slightly from low-water techniques (F&G photo: Norm Peterson). High flows (below) play an important role in forming and maintaining channel features that provide habitat for fish and other aquatic animals (F&G photo: Tom Warren).

sharing their disappointment. The consensus, arrived at while the coffee pot was being emptied, was that "a stream just isn't fishable when it's high." They finally decided to put their gear away and return home.

Were our friends correct in their assessment of the fishing potential? Probably not. Although the water was high, the stream wasn't flooding or even full to the banks. These anglers' techniques for locating and catching trout were based on low water conditions, and simply weren't effective during higher flows. Trout *can* be taken during high water with methods that are only slight modifications of low-water techniques.

Trout are primarily sight feeders, so visibility plays a major role in their feeding behavior. Studies have shown that olfactory (smell) senses are also involved and these may be more important than sight in turbid water when visibility is reduced. Whatever the process, a trout can readily locate food, even in extremely turbid water.

Bait fishing is the best choice for stream angling during high water, when scouring action increases the drift of food organisms. Trout feed primarily on aquatic insects and other invertebrates at this time, and live bait drifted with this food supply offers the best chance to attract a trout.

The common and ever-popular night crawler is often the best bait under such conditions. These are rarely found floating in streams, but for reasons known only to trout, they are an effective bait throughout the year. Because of their size, they are more visible than the smaller insects in turbid water. During the hatch, salmon flies are also effective bait. Trout feed heavily on adult salmon flies that move along the streambed near the shoreline.

Spinning rods are best suited for stream fishing during high water. Some anglers prefer a rod with a parabolic action, which simply means the flexibility increases progressively as you near the tip. A light- to medium-weight rod with a sensitive and flexible tip reduces the possibility of losing a soft bait during the cast and also telegraphs the nibbling action of the trout as it picks up the bait.

Monofilament line of eight- to 10-pound test is recommended during high water. This heavier line is less likely to break when the hook or sinker hangs up on a rock or snag, and it also provides the extra strength needed to turn a trout that tries to run with the fast current. Some anglers prefer fluorescent line for better visibility. These lines may also be more visible to the fish, but that disadvantage can be offset by using a six- or eight-foot leader of clear monofilament.

Size 2 or 4 bait-holding hooks with two or more barbs along the shank are best for this type of fishing. These hooks hold the bait firmly in place during the cast and also while the line is drifting along the streambed. During low water, most fishermen prefer a small hook that can be concealed within the bait. However, with the reduced visibility in turbid water, a larger hook can be used. The larger hook will minimize missed strikes and will also reduce the possibility of a small trout swallowing the hook. Small fish hooked in the mouth can be released unharmed.

The amount of weight needed depends on water velocity and length of the cast. The sinker should be the smallest size that will keep the baited hook drifting freely along the streambed. Carry an assortment of split shot sinkers and adjust the weight to fit the flow conditions.

Cover conditions will change with increased flows, but trout always select sites that provide security and protection near a feeding site. Undercut banks harbor trout under any flow conditions, but these areas are difficult to fish during high water. Undercuts are usually located in outside bends where high water velocity makes line control difficult. Trout will also be found in the slack water behind submerged boulders, along the edges of the deep-water runs and at the heads of pools, where they wait for food organisms drifting in from the riffle areas.

A good approach is to select likely looking cover with moderate water velocity and cast the bait several feet upstream from that spot. Allow the bait to sink and drift along the streambed as it passes the cover that you think might hold a feeding trout. You will feel the sinker bouncing over the rocks and, with a little experience, you can distinguish this action from the tug of a nibbling trout.

Raise the rod tip sharply a few inches each time the sinker hits the streambed to minimize snagging and to keep the bait drifting naturally. Slack line will cause missed strikes, so hold the rod tip high and use short casts. Longer casts will expose more line surface to the current and cause the line to "belly." With the reduced visibility in turbid water, long casts are unnecessary.

Most trout fishermen prefer to wade and fish upstream when water is low and clear. Anglers believe they are less likely to spook the trout with this approach. However, visibility is lower in turbid water, and downstream wading offers some advantage when flows are up. It is easier to wade with the current than against it and the insects that are dislodged by wading will often attract trout and stimulate feeding in areas downstream.

The high-water period offers a bonus that may become more important in the future. Each year, Montana's streams see an increase in fishing pressure, especially during summer. But even on the most popular streams, pressure is light during other seasons. Most fishermen avoid the run-off period, so pressure is especially light at that time. The angler who wants to avoid crowds and heavily fished areas can find lots of room on Montana streams during spring run-off.

What are the effects of high water on stream channels and on the fish that inhabit them? Not as dire as many fishermen think. High flows during run-off are part of the natural flow regime in all streams, excluding a few spring-fed creeks. If a river and its adjoining watershed are properly managed, the channel can withstand run-off without damage and will actually benefit from the high flows. These above-average flows play an important role in forming and maintaining channel features that provide habitat for fish and other aquatic animals.

The water flowing through a stream channel is continuously moving some material through the system. At low flow this movement may be imperceptible, but during

high water, larger particles and more material will be transported. High flows scour material from the pool areas and redeposit it at some point downstream. This action maintains the depth necessary to provide cover for fish in the pools and runs.

Woody vegetation along the stream bank plays a vital role in maintaining desirable channel features, especially during high flow periods. The roots of woody plants bind the soil particles together and thereby regulate the rate of bank erosion. This maintains the undercuts and deep water areas so important to many fish species. When woody vegetation is removed, the channel becomes wide and shallow with little cover and habitat for fish, especially the larger fish sought by most anglers.

Riffles are also very important for many species, especially trout. These shallow areas produce most of the food organisms and also provide spawning areas for a variety of fish. Velocities are highest in the riffle areas and the flushing action of high water clears silt and other fine material from them, maintaining suitable habitat for aquatic insects and incubating trout eggs. Insects live on clean rock surfaces in the riffles and silt accumulations greatly reduce the number and variety of these food organisms. A reduced food supply means fewer fish and slower-growing fish.

Trout eggs are buried in the gravel and require constant aeration by water—which of course contains oxygen—flowing through the gravel. If silt accumulates in the riffle areas, the flow through the gravel is reduced or even stopped and trout eggs suffocate. Reduced egg survival because of increased siltation in the streambed is a major factor in declining trout populations in many Montana streams.

Periodic flooding is also a natural part of the flow regime of most streams. When run-off or discharge exceeds the capacity of the channel, the excess water spills out onto the floodplain. If riparian (streamside) and floodplain vegetation is intact and well-managed, the adverse effects of flooding on channels and floodplains are minimal and short-term. Flood waters carry large amounts of fertile sediments, which settle on the floodplain and become part of the topsoil. Some of the flood water also soaks into the ground where it is available to growing plants and where it becomes part of the ground water that supplies wells, springs and streams.

Studies have shown that flows equal or exceed the "bank-full" condition in two of every three years on most streams. Much of this flooding is minor and the long-term benefits of soil building, waterspreading and channel cleaning usually outweigh any adverse effects.

Major flooding occurs on all streams at less frequent intervals—perhaps every 50-100 years—and often results in damage to life and property. Most of man's activities, from ancient times to the present, have been closely allied to the world's rivers and adjoining valleys. Our highways, major industrial developments and cities are often located on or near the banks of rivers. Therefore, some damage is inevitable when major flooding occurs. Although flooding is a natural phenomenon, we tend to blame the stream when it overflows its banks and sends water into our houses, factories and transportation systems.

Over the years, billions of dollars have been spent on a variety of flood control projects, including channel alteration, dredging, diking and dam construction. In spite of these efforts, flood damage continues to increase. Experience has shown that efforts to control floods by channel alteration are largely ineffective. These practices have not only failed to solve flood problems, but they have also been very harmful to aquatic ecosystems. Several recent federal and state laws have placed constraints on this type of channel modification.

Diking has been (and still is) a common method of protecting property from flood waters. Dikes or levees are frequently built to protect high-value property or population centers by diverting flood water to less critical areas. If a dike is located close to the river bank, the energy of the additional water causes extensive scouring of the channel with a subsequent loss of fish habitat. Channel damage can be minimized if dikes and levees are located farther from the stream bank.

Dams built for flood control range from small watershed projects to large multipurpose dams on major rivers. The first impact of any dam is loss of stream habitat in the reservoir area. This loss is complete and irreversible for the life of the project. Releases from the dam will determine the fate of fish habitat downstream. The more these releases deviate from the natural flow regime, the greater the loss of fish habitat. The life habits and needs of trout are adaptations to seasonal flow variations; these species do not do well when high flows and velocities are eliminated. Low stream flow is common below dams, significantly reducing fish habitat in many impounded streams. If peak spring flows are not simulated by releases, the flushing action of run-off is lost and the diversity of channel features that provide fish habitat is reduced. Multipurpose projects often use the stream channel to transport water to some downstream location. If flows are maintained near bank-full levels for extended periods, excessive scouring will degrade channel shape and fish habitat. At least two Montana waterways—the Beaverhead River and Big Spring Creek—have been adversely affected by this practice in recent years.

These traditional methods of flood control are still in use, but recent trends have been toward legislation that regulates new developments in flood-prone areas, adjusts land-use practices in critical drainages and provides flood insurance to compensate for losses.

No doubt, many fishermen will continue to view spring run-off as a time when fishing conditions are less than ideal. However, trout *can* be taken during this period; it is a time when Montana's streams can be used and enjoyed under uncrowded conditions. But even if you don't fish your favorite stream during run-off, you will benefit from the action of high water. Without these seasonal high flows, your stream would eventually lose most of the pools, runs and undercuts, significantly reducing trout production. High water is really the trout fisherman's friend. ■

The Red Fox: A Coat of Many Colors by Frank Gjersing

THE MORNING was cool with a gentle breeze blowing from the southwest. A light dew shimmering in the early light made the world look as if a carpet of diamonds had been laid down during the night. The month of May was at its best.

I was spending the early morning observing the spring antics of a group of ducks on a small marsh in north central Montana. As I watched the scene, I gradually became aware of a slow-moving orange shape drifting through the grass at the edge of the water. The stealth with which the animal moved was fascinating. Less than 10 yards in front of me, a sudden dash was terminated by a high-pitched squeak, and a red fox sat down to enjoy a meadow mouse. It took me some time to snap back to reality: I was watching one of the most controversial animals in North America.

Few, if any, predators have had more attention paid to them than the red fox (*Vulpes fulva*). Its antics are woven through the myths of time, abound in folklore and fairy tales and today are expounded from smoke-filled English pubs to the somber scientific circles of the West. It has contributed to victories by politicians riding the bandwagon of predator control. Finally, the red fox has given ulcers to many game biologists trying to separate fact from fiction when communicating with a misinformed public.

What are the "facts" about this small 10- to 15-pound member of the dog family? Fossil records of its ancestors go back almost 50 million years, so it obviously fits solidly in nature's scheme. It is a predator and, of all nature's creatures, predators seem to be the hardest for man to view objectively. But only by doing this can we draw an accurate picture of the red fox.

The red fox is distributed throughout almost all of North America, except the far North, parts of Canada's coast, the deep southeast and Florida. Mating usually occurs in January or February and from four to nine young are born in April or May, after a gestation period of about 51 days. The parents are monogamous (taking a single mate) and both care for the young. At about five weeks, the young emerge from the den and soon begin short hunting trips with the parents.

There are probably more stories about the predatory craftiness and guile of the fox than about any other animal, except possibly the wolf. But studies have shown that the red fox, like most predators, is an opportunist and takes the prey most conveniently available. So, its staple diet comprises mice and rabbits during most seasons. When abundant, grasshoppers and other insects may tempt the red fox's palate, thus providing a little-known benefit to farmers and ranchers. Foxes are not limited to a protein diet and may consume considerable vegetable matter, such as waste apples in orchards. But occasional forays into the farmer's chicken yard and the utilization of game birds for food are the habits that have given the red fox a bad name.

When the opportunity presents itself, foxes eat game birds—either birds they have killed themselves or carrion (those found dead). They have been known to systematically utilize pheasants killed by highway traffic. As with all predators, their effect on a prey species reflects the security or insecurity of the prey within its environment. Locally and temporarily, they can have a severe impact on a prey species; however, they seldom have a negative, long-term effect.

An example of the negligible effect of predator upon prey occurred during the 1940s when pheasants and foxes were abundant in many midwestern ranges. Many people blamed foxes when pheasant populations crashed in 1944-45. Yet pheasants in an area without foxes (Pelee Island in Lake Erie) suffered the same crash. Efforts to increase prey species such as pheasants by controlling foxes seem to be nothing more than politically attractive, popular and costly exercises in futility.

When food is abundant, foxes cache both prey they kill and carrion throughout their home ranges. When food becomes scarce, they return to their various caches to eat. This "saving for a rainy day" has undoubtedly led to some of the legends extolling their intelligence.

However, the most intriguing stories come from people who have actively pursued foxes—on foot, with horse and hounds or by trap line. Foxes have been observed doubling back on their trails, running along the tops of fences or stone walls and swimming back and forth across streams, apparently to break up their trails. But whether these activities are due to instinct, intelligence or learned effort is probably best left to the decision of the person who has been "outfoxed."

Not only do foxes prey on other animals but they are also sometimes preyed on by goshawks, golden eagles, coyotes, lynx, bobcats and cougars. In North America, foxes are pursued mainly by man. The pelt, when prime, is highly prized by trappers and may include a variety of colors and shades. In addition to the common yellowish-red to reddish-brown color phases, silver or black phases may occur. A fairly common phase is the "cross fox," so named because of the black cross formed by a line down the middle of the normally reddish back and another dark line across the shoulders. In all color phases, the red fox maintains its characteristic black feet and white tip on its tail.

To the various people it encounters, the fox may always seem to wear a coat of many colors. To the farmer whose land is overrun by mice, it may be a friend. To the hunter with an eye on a favorite pheasant or to the farmer who has had an unpleasant and costly encounter with it in his chicken yard, the red fox may be considered a foe. To the trapper, its pelt may provide a needed source of income. But whatever it may appear to be, the red fox will always be part of the completeness of nature; as a predator, it will always fit into "the equation of life." ■

The Land Where The Rivers Join

by Dick Ellis

DURING THAT DISTANT geologic time when massive glaciers gouged and shaped the landscape of North America, the beds of three mighty rivers were filled by snowmelt from smaller mountain glaciers in the area. The rivers were to be named the Madison, Gallatin and Jefferson.

Each was unique, yet alike in a common destiny. Twisting, churning and flowing through a combined distance of hundreds of miles, they abandoned their individual courses at a single geographic point and merged to create a new force—one of the major rivers of the world, the mighty Missouri.

This geographic point of mergence and emergence, of ending and beginning, is more than a landmark; it is an ancient focus of man's interaction with man and nature, a goal of exploration and a crossroads of frontier commerce. To modern man, it has become known as the Headwaters of the Missouri.

PREHISTORY

Man probably first encountered the headwaters more than 12,000 years ago when primitive nomadic hunters ventured into the interior of an unexplored continent. Intermountain valleys formed by the Madison, Gallatin and Jefferson were appealing travel routes which funneled early man to the vicinity of the headwaters.

Here, for hundreds of generations, primitive man interacted with nature in episodes of peace and conflict, joy and sorrow, famine and plenty. Archaeologists are slowly uncovering and analyzing the physical evidence of early man's tenure. Until that story is fully told, our imaginations must fill in the details. We can readily envision the early hunter ascending the surrounding heights to search out the woolly mammoth, the giant bison and the primitive camel which shared his world. We can imagine stalking the giant creatures and casting flint-tipped spears with the aid of a "spear thrower." (It would be much later in the evolutionary scheme that introduction of the bow and arrow into the New World would give man additional advantage in the hunt.) Returning from our stalk, we can envision the camp on the plains below—where children frolic and where the products of the land are transformed by skilled hands into food, clothing, shelter and tools.

Over the vast span of time that primitive nomads visited the headwaters area, they left no written record and little archaeological evidence. Theirs was a way of life keyed closely to nature, which changed little over the centuries. Although today their impact on the land is barely discernible, it was they who dominated the area for most of its history.

During the closing hours of this prehistoric era, more familiar Indian cultures, such as the mountain-adapted Shoshone, developed. The Blackfeet from the north, the Crow and Sioux from the east and the Flathead and Nez Perce from the west became familiar with "the land where the rivers join," and partook of its bounty.

When European explorers first set tentative foot in the

The site of the Missouri Headwaters State Park (far left, F&G photo: Dick Mayer) is an area rich in recreational potential and history. On July 25, 1805, Meriwether Lewis (left) and William Clark and their Corps of Discovery arrived at "The Land Where the Rivers Join"—the spot where the Madison, Gallatin and Jefferson join to form the mighty Missouri. Shown between the two captains of the expedition are Lewis' maps of the headwaters area. A great blue heron rookery (above, F&G photo: Mike Aderhold), only one of 90 bird species recorded in the headwaters area.

area, they found an uncontested land, perhaps dominated occasionally by one tribe or another, but historically held by none.

EXPLORATION

The headwaters of the Missouri had long been a goal of explorers dreaming of fabled cities of gold, an inland passage to the Orient and lands rich in furs and minerals. But it was not until the early 1800s that white men were finally to view the Missouri's birthplace and pen their impressions.

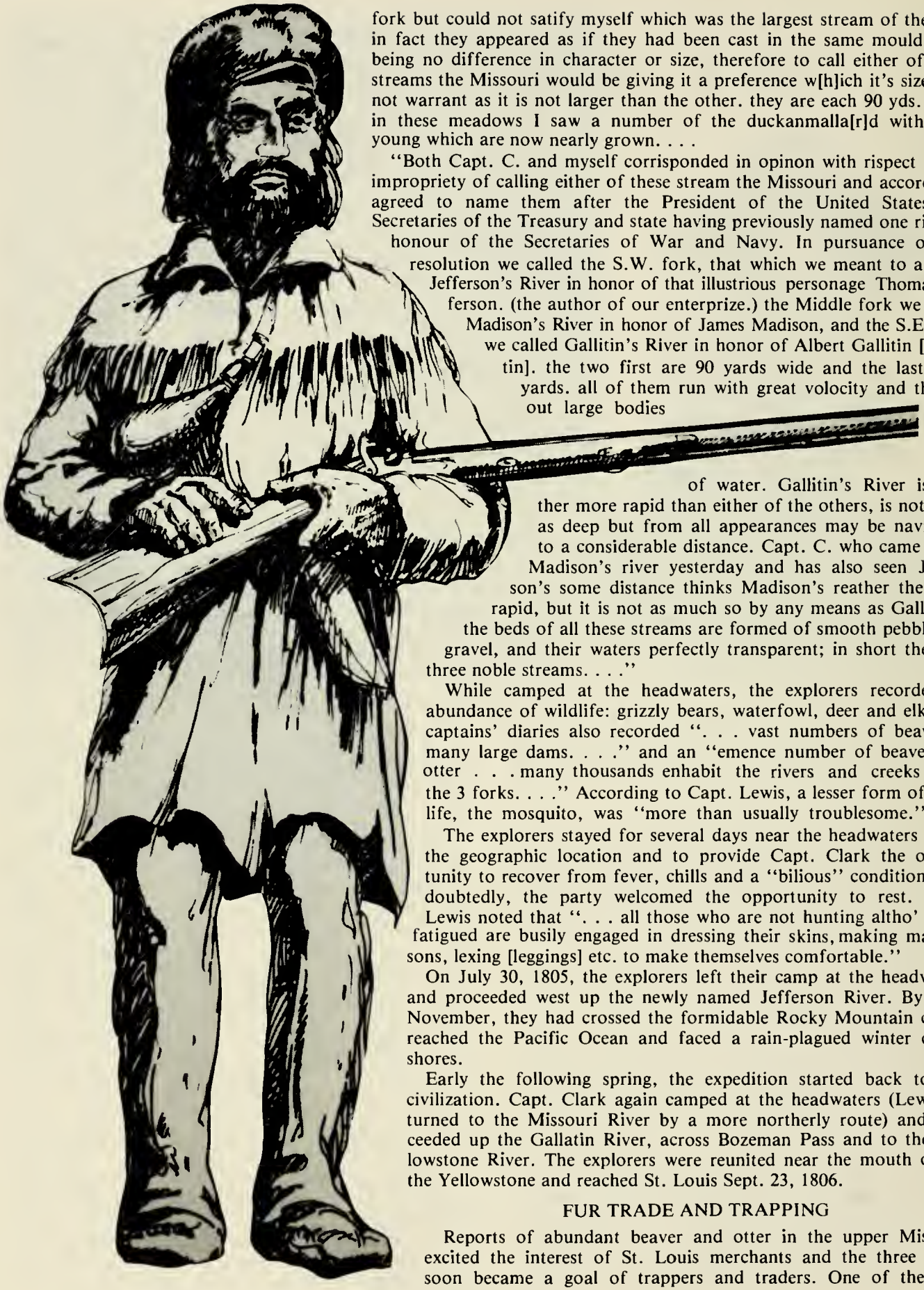
In 1803, the United States acquired the Louisiana Purchase, a vast tract of land reaching from the Mississippi River Valley westward to the Rocky Mountains and from the Gulf of Mexico northward to Canada. Soon after, President Thomas Jefferson hurried to fulfill a long-held dream—exploration of the western interior of the New World and determination of the existence (or nonexistence) of an inland water route to the Pacific Ocean.

On May 14, 1804, the famous Corps of Discovery, led by Capts. Meriwether Lewis and William Clark, left St. Louis and began the long journey up the Missouri River. Fourteen months later, on July 25, 1805, following a winter with the Mandan Indians in what would become North Dakota, the first contingent of the expedition arrived at the three forks of the Missouri.

The well-seasoned corps had by now surmounted over 2,400 miles of relentless current and had successfully met all challenges. Throughout the entire trek, they faithfully made daily entries in their journals. Entries by Capt. Lewis while at the headwaters include:

"Saturday July 27th 1805.—. . . At the junction of the S.E. fork of the Missouri and the country opens suddonly to extensive and beatiful plains and meadows which appear to be surrounded in every direction with distant and lofty mountains; supposing this to be the three forks of the Missouri I halted the party on the Lard. shore for breakfast. and walked up the S.E. Fork about ½ mile and ascended the point of a high limestone clift from whence I commanded a most perfect view of the neighbouring country . . . after making a draught of the connection and meanders of these streams I decended the hill and returned to the party . . . here I encamped to wait the return of Capt. Clark and to give the men a little rest which seemed absolutely necessary to them. . . .

". . . believing this to be an essential point in the geography of this western part of the Continent I determined to remain at all events until I obtained the necessary data for fixing it's latitude Longitude &c. after fixing my camp I had the canoes all unloaded and the baggage stoed away and securely covered on shore, and then permitted several men to hunt. I walked down to the middle fork and examined and compared it with the S.W.



fork but could not satify myself which was the largest stream of the two, in fact they appeared as if they had been cast in the same mould there being no difference in character or size, therefore to call either of these streams the Missouri would be giving it a preference w[h]ich it's size dose not warrant as it is not larger than the other. they are each 90 yds. wide. in these meadows I saw a number of the duckanmalla[r]d with their young which are now nearly grown. . . .

"Both Capt. C. and myself corrisponded in opinon with rispect to the impropriety of calling either of these stream the Missouri and accordingly agreed to name them after the President of the United States and Secretaries of the Treasury and state having previously named one river in honour of the Secretaries of War and Navy. In pursuance of this resolution we called the S.W. fork, that which we meant to ascend, Jefferson's River in honor of that illustrious personage Thomas Jefferson. (the author of our enterprize.) the Middle fork we called Madison's River in honor of James Madison, and the S.E. Fork we called Gallitin's River in honor of Albert Gallitin [Gallatin]. the two first are 90 yards wide and the last is 70 yards. all of them run with great volocity and th[r]ow out large bodies of water. Gallitin's River is reather more rapid than either of the others, is not quite as deep but from all appearances may be navigated to a considerable distance. Capt. C. who came down Madison's river yesterday and has also seen Jefferson's some distance thinks Madison's reather the most rapid, but it is not as much so by any means as Gallitin's. the beds of all these streams are formed of smooth pebble and gravel, and their waters perfectly transparent; in short they are three noble streams. . . ."

While camped at the headwaters, the explorers recorded an abundance of wildlife: grizzly bears, waterfowl, deer and elk. The captains' diaries also recorded ". . . vast numbers of beaver in many large dams. . . ." and an "emence number of beaver and otter . . . many thousands enhabit the rivers and creeks near the 3 forks. . . ." According to Capt. Lewis, a lesser form of wildlife, the mosquito, was "more than usually troublesome."

The explorers stayed for several days near the headwaters to fix the geographic location and to provide Capt. Clark the opportunity to recover from fever, chills and a "bilious" condition. Undoubtedly, the party welcomed the opportunity to rest. Capt. Lewis noted that ". . . all those who are not hunting altho' much fatigued are busily engaged in dressing their skins, making mackersons, lexing [leggings] etc. to make themselves comfortable."

On July 30, 1805, the explorers left their camp at the headwaters and proceeded west up the newly named Jefferson River. By early November, they had crossed the formidable Rocky Mountain chain, reached the Pacific Ocean and faced a rain-plagued winter on its shores.

Early the following spring, the expedition started back toward civilization. Capt. Clark again camped at the headwaters (Lewis returned to the Missouri River by a more northerly route) and proceeded up the Gallatin River, across Bozeman Pass and to the Yellowstone River. The explorers were reunited near the mouth of the the Yellowstone and reached St. Louis Sept. 23, 1806.

FUR TRADE AND TRAPPING

Reports of abundant beaver and otter in the upper Missouri excited the interest of St. Louis merchants and the three forks soon became a goal of trappers and traders. One of the first

white men to utilize this resource was John Colter, a valued member of the Lewis and Clark Expedition who chose to remain in the wilderness rather than return to civilization. During the next two years of trapping and exploring, Colter twice visited the headwaters area and twice nearly lost his life in encounters with the fierce Blackfeet: first, as an inadvertent "participant" in a major Indian battle and second, as the naked, barefoot quarry in a six-mile foot race against a large war party. Miraculously, he managed to kill one of his pursuers, outdistance the rest, escape into the waters of the Jefferson and make his way on foot over the Bridger Mountains to safety.

By 1810, the newly formed Missouri Fur Company, dominated by Manuel Lisa, had established a profitable trading post at the confluence of the Yellowstone and Bighorn rivers and was prepared to extend its influence to the valleys of the three forks. A party of 32 trappers, guided by Colter, arrived at the headwaters in March and began to construct a fort. By early April, trapping parties had set out in hope of reaping a rich harvest but met fierce resistance from the Blackfeet and nearly equal harassment from numerous grizzly bears.

Colter, fearing his luck was finally to run out, soon left the post with two companions and within 30 days had paddled nearly 2,500 miles to St. Louis—the spot he had departed from over six years before.

The rest of the trappers who had stayed at the three forks post continued to experience relentless pressure from the Blackfeet; following the deaths of three more of the party (one of whom was George Drouillard, an invaluable hunter and interpreter for Lewis and Clark), the enterprise was abandoned.

This determined resistance by the Blackfeet was to essentially close the headwaters area to trappers for nearly 20 years. Although sporadic attempts were made, it was not until the 1830s that trade was established with the Blackfeet and large trapping parties again visited the headwaters.

Before fur trading declined, the headwaters area was the setting for a particularly tragic episode in the saga of white man-Indian conflict. The dreaded smallpox was brought up the Missouri in 1837 and spread immediately throughout the Indian nations. When the Blackfeet failed to visit the trading posts as expected, traders went in search of them. When they reached the three forks, they found a large camp with only two people left alive and reported that "hundreds of decaying forms of human beings, horses, and dogs lay scattered everywhere among the lodges." Perhaps half the entire Blackfeet population died that summer from the "white man's disease."

FRONTIER SETTLEMENT

As the exciting era of the fur trade succumbed to changing tastes in dress and a declining beaver population, another wave of frontier activity was about to be felt at the Headwaters of the Missouri.

In the early 1860s, gold was discovered in Montana and "gulches" bearing such names as Grasshopper, Alder, Last Chance and Confederate saw boom towns and mining camps grow, seemingly overnight. Where the fur trade had temporarily attracted hundreds to the western mountains, the gold frenzy brought thousands—and most of them stayed.

Instantly, a great demand for food, clothing, tools and a vast array of other necessities and luxuries developed, all of which had to be transported from eastern trade centers. From the outset, the Montana gold fields were supplied by two routes: via freight wagons from the nearest rail head in Utah or an equally arduous route from the head of steamboat navigation on the Missouri. At best, both routes were long and unreliable.

In 1862, an enterprising group of Missourians endeavored to ease the supply problems by extending steamboat traffic all the way to the Three Forks of the Missouri. Envisioning a short freight haul around the Great Falls and transfer to light steamers, the organization founded the Gallatin Town Company and enthusiastically laid out a townsite on the north bank of the Missouri, nearly opposite the mouth of the Gallatin River. Although 60 cabins were being built (mostly on speculation) in 1863, the anticipated steamboat trade never developed and, within two years, the organization's original goals had been adandoned.

Responding to the need for a townsite—steamboats or no—many residents relocated to a more suitable site across the river. This "second" Gallatin City more or less prospered for 10 years and served as the first county seat of Gallatin County. It boasted a ferry crossing of the Missouri, a grist mill, stoves, a school, a hotel and even hosted a regional agricultural fair complete with oval track horse racing.

Very little now remains of Gallatin City. It was slowly abandoned as a system of toll bridges and roads was developed at a more favorable location to the west. By 1870, the headwaters was the site for the closing of another historical chapter.

For centuries, the headwaters had served both as a focal point and a crossroads of man's activity. The demise of Gallatin City was to result in only a short interlude of inactivity.

During the late 1800s and early 1900s, the headwaters was traversed by two railroads, a highway and numerous transmission and telephone lines. The lines follow valleys cut through rocky barriers by the timeless flowing of the rivers—valleys which provided attractive thoroughfares for commercial interests forging communication links across the state and nation. These modern engineering feats, countered by free-flowing rivers and undisturbed bottomlands, are today's testimony to the fact that the headwaters is indeed a pivotal point in man's interaction with man and with nature.

PARK DEVELOPMENT

On July 25, 1976, during the year of the nation's 200th birthday and 171 years after the landing of the Lewis and Clark Expedition, several hundred persons from throughout Montana gathered at the Headwaters of the Missouri to take part in a special celebration. The headwaters was officially dedicated as Montana's bicentennial site. Following vigorous statewide competition, the headwaters emerged as the winner, primarily because of its intriguing role in history and its recreational potential. The entry was conceived and

sponsored by the Headwaters Improvement Project Subcommittee of the Gallatin County Bicentennial Committee. This subcommittee also participated actively in designing improvements to the area and was totally responsible for the bicentennial celebration arrangements.

As winner of the bicentennial competition, the Missouri Headwaters State Park received a $250,000 legislative appropriation which, when matched with a Federal Land and Water Conservation Fund grant, financed extensive interpretive and recreational development. Today, visitors can enjoy modern campground and picnicking facilities and indulge in imaginative trips into the past with the aid of many interpretive displays.

Although part of the park has been developed for the visitors' convenience, much of it still remains natural. As a result, many species of birds and mammals may be found; over 90 bird species have been recorded. Cottontail rabbits and small rodents are abundant and they, in turn, attract red foxes and an occasional coyote.

hardy explorers.

To many, recognition and development of the headwaters as an outstanding historic park were long overdue. Local citizens became interested in developing an historic park in the vicinity in the 1920s, with the late Clark Maudlin, a former resident of Three Forks and Anaconda, offering leadership and guidance. A "Founders' Club" was organized and the group raised money for acquisition and development of a park. In 1947, Maudlin and the "founders" presented 21 acres to the state of Montana for park development.

A long period of unsuccessfully asking the legislature for funding followed. Although Maudlin and the "founders" initiated development with donated funds, it was not until 1957 that the state finally received a legislative appropriation for operation and maintenance of the Missouri Headwaters State Park.

For the next several years, limited financing provided only caretaker services and minimal maintenance of

This old wooden structure is the former Gallatin City Hotel. The formerly elegant hotel was turned into a barn and many of its timbers were carted away and used elsewhere.

Existing Structure

Visitors often spot white-tailed and mule deer at the edges of open meadows and secretive moose frequent the dense willow bottoms.

As one might expect at the junction of several major rivers, fishing is a popular and often rewarding activity, with rainbow and brown trout the prime quarry of anglers.

A convenient launch site is situated at the mouth of the Gallatin River and the water-oriented recreationist can enjoy exceptional floating on the Missouri and its tributaries. Those interested in history may enjoy floating in the wake of Lewis and Clark (in reverse, of course) and the serious history buff might want to try maneuvering *upstream* on the same rivers faced by these

parking and picnicking facilities. In 1965, responsibility for state parks was assumed by the Department of Fish and Game and shortly thereafter, the headwaters area was greatly enhanced by acquisition of nearly 500 adjacent acres. Slow but steady improvement of park facilities culminated in rapid bicentennial development in 1976-77.

The Missouri Headwaters State Park has now become the destination of ever-increasing numbers of Montanans and out-of-state visitors who wish to see for themselves the birthplace of the mighty Missouri, communicate with the past or simply enjoy the recreational opportunities in Montana's beautiful outdoors. ■

The Catchall

Neighboring Anglers Catch Record Fish, Too

Like box scores, batting averages, racing forms, pay scales and tax tables, state fishing records have their fans. Just for fun, this year we've included the fishing records for our neighboring states and provinces, as well as some world records.

The record-keeping of our Canadian neighbors is impressive. Alberta's record book is maintained and published by the Alberta Fish and Game Association, a private organization with 34 affiliated clubs and 24,000 members and also by Alberta's Department of Recreation, Parks and Wildlife. The association prints a 21-page "Wildlife Trophy Record Book" listing the annual fishing records since 1963, plus the provincial record and the world record for 13 game species. The book is updated annually and also contains Boone and Crockett records for big game, weight records for three game bird species and a full page of instructions for entrants. The department updates the same fishing records (but adds two species) in its annual sport fishing regulations.

Saskatchewan used to have a list with over 1,200 records. For five years (1969-73), the Saskatchewan Department of Tourism and Renewable Resources supported a countrywide "anglers' derby." Certificates and bronze pins were awarded to anglers entering fishes weighing above a minimum weight in 12 species categories. Silver pins were presented to the angler landing the largest fish in each classification. Labatt's Saskatchewan Brewery provided the awards. It was a popular contest and jumped from 167 entries in 1969 to 1,219 entries from all over North America in 1973. In 1972, 606 northern pike weighing 18 pounds and over and 183 arctic grayling over two pounds were listed; in 1973, 245 rainbow trout over four pounds were recognized. Unfortunately, law enforcement officers and fisheries biologists found that some anglers were releasing large numbers of small- to medium-sized fish in favor of retaining large, trophy-sized fish. A significant loss of released fish was reported and in 1974 the Saskatchewan resource agency stopped supporting fish derbies.

South Dakota's record list has the most species—52. The state's list includes the common shiner, red shiner and sand shiner at .4515, .0448 and .1240 ounces, respectively. South Dakota claims the world record for orange-spotted sunfish at .4578 ounces. Montana is the only state listing a white sucker. Jim Crants, an angler from Wolf Point who previously held Montana's walleye record, brought the big sucker into the Glasgow regional office and asked if we would enter it in our record book. It's the only new species added this year, but one of five new records (see table).

Montana, Alberta and North Dakota all have the same northern pike record at 37 pounds, 8 ounces. Montana's new channel catfish record and last year's

The white sucker was added to Montana's 1978 list of record species when Jim Crants of Wolf Point caught this 3-pound, 7-ounce specimen. He was jug fishing in Nelson Reservoir in Phillips County and used live minnow bait. F&G photo: Mike Aderhold

Paul Voss, Choteau, with his 13-pound, 4-ounce walleye—the largest walleye documented out of the Milk River. The big fish, taken just west of Hinsdale, was only 12 ounces short of the 14-pound state record caught in Nelson Reservoir in 1974 by Neil Berg of Wolf Point. When Paul caught the fish, he was checking the fishing jugs set out by his stepson, Gary Dreikosen, Hinsdale. And it might be just as well the walleye wasn't a state record because there was some question about whose name would have gone in the record book—Gary who put the line in the water or Paul who took the fish out. F&G photo: Mike Aderhold

recycled paper

bigmouth buffalo record—while big—are still the smallest listed.

The world records listed appeared in the February 1978 *Field and Stream*. Some of the state and provincial records exceed these recognized world listings, such as Wyoming's golden trout, Idaho's white sturgeon and Alberta's and Idaho's mountain whitefish records. This is probably because these records were not submitted to *Field and Stream*. Although world records for these species are not included in our table, Montana's paddlefish and pallid sturgeon, Wyoming's burbot and Alberta's goldeye exceed any other known angling records.

Every year after printing Montana's record list, we are informed about larger catches. Like *Field and Stream*, we obviously cannot list fish we don't know about or those not properly verified. We require only that the fish (1) be legally harvested, (2) be weighed on an inspected scale and (3) be positively identified. To maintain the integrity of the list and to protect the interests of current record holders, we ask that a record fish be documented and verified by Fish and Game personnel *whenever possible*. If the species has not been documented by a Department of Fish and Game employee, the angler must present a photograph from which the fish can be properly identified.—*Mike Aderhold, Region 6 (Glasgow) information officer*

• *Thanks to the Alberta Department of Recreation, Parks and Wildlife, Alberta Fish and Game Association, Idaho Department of Fish and Game, North Dakota Game and Fish Department, Saskatchewan Department of Tourism and Renewable Resources, South Dakota Department of Game, Fish and Parks, Wyoming Game and Fish Department and* Field and Stream *for their assistance in compiling this article.*—Ed.

Veterinarian Deserves Special Recognition

Work donated to the Department of Fish and Game by Dr. Anthony Pajas, a Libby veterinarian, has resulted in a new lease on life for a black bear and cougar.

The black bear was hit by a car and its front leg was broken. Dr. Pajas placed a pin in the leg in a surgical procedure which lasted almost four hours.

Fishing Rec

Species	MONTANA Weight lbs.	ozs.	Angler	Year	Location	N. DAKOT Weight lbs.	ozs.
Bigmouth buffalo	25	3	Gaylord Hagen	1977	Fort Peck dredge cuts	30	0
Black bullhead	1	11	Mike Mitchell	1977	Horse Creek (McCone Co.)	3	8
Black crappie	3	2	Al Elser	1973	Tongue River Reservoir	3	0
Bluegill	2	8	George Schlosser	1967	Dengel Reservoir	2	12
Brook trout	9	1	John R. Cook	1940	Lower Two Medicine Lake		
Brown trout	29	0	E. H. "Peck" Bacon	1966	Wade Lake	14	2
Burbot (ling)	12	9¾	Tom Colgan	1977	Missouri River	16	8
Channel catfish**	**22**	**6**	**Robert Opp**	**1978**	**Yellowstone River**	26	8
Coho salmon	4	14	Irven Stohl	1973	Fort Peck Reservoir	10	2
Cutthroat trout	16	0	William D. Sands	1955	Red Eagle Lake		
Dolly Varden	25	10	James Hyer	1916	Unknown		
Drum	13	6	George Gallagher	1973	Fort Peck Reservoir	16	0
Golden trout	2	9	Raymond D. Gallik	1975	Lightning Lake		
Goldeye	2	9	Lester Estenson	1977	Nelson Reservoir		
Grayling	2	10	Mark Daniels	1974	Handkerchief Lake		
King salmon (chinook)	4	7	Berry Gillis	1972	Missouri River		
Kokanee salmon	5	15	Forrest Johnson	1976	Pishkun Reservoir		
Lake trout	41	8	John E. Boller	1975	Flathead Lake	5	4
Lake whitefish**	**4**	**7½**	**Jim Frame**	**1978**	**Echo Lake**		
Largemouth bass	7	6	Jere Hightower	1973	Ninepipe Reservoir	7	12
Mountain whitefish	4	9¾	Mike Hangas	1977	Blackfoot River		
Northern pike	37	8	Lance Moyler	1972	Tongue River Reservoir	37	8
Paddlefish	142	8	Larry Branstetter	1973	Missouri River	93	0
Pallid sturgeon	47	0	Donald Rohlf	1977	Fort Peck tailwaters	41	0
Rainbow trout	20	0	C. J. Brohaugh	1952	Cliff Lake	15	12
Rainbow-cutthroat hybrid	17	10	R. A. Rousselle	1973	Ashley Lake		
Sauger	7	2	Raymond V. Johnston	1975	Tongue River Reservoir	8	12
Shortnose gar	3	1	John Johnson	1977	Fort Peck dredge cuts		
Shovelnose sturgeon**	**12**	**12**	**Troy Sidewell**	**1978**	**Marias River at Loma**		
Smallmouth bass	4	11½	Bob Higson	1975	Horseshoe Lake	4	5
Squawfish	5	0	Alfred Arvidson	1977	Flathead Lake		
Walleye	14	0	Neil Berg	1974	Nelson Reservoir	15	12
White crappie**	**2**	**2**	**Drew Jackson**	**1978**	**Tongue River Reservoir**		
White sturgeon	96	0	Herb Stout	1968	Kootenai River		
White sucker***	**3**	**7**	**Jim Crants**	**1978**	**Nelson Reservoir**		
Yellow perch	2	0	Gerald Pottratz	1974	Nelson Reservoir	2	4¾

**New Montana records for 1978

***New species added to Montana fishing records in 1978

In May 1978, Dr. Pajas saved a female mountain lion which had a broken hind leg and crushed pelvis. He put a metal pin in her leg and, in a second operation, removed the metal pin and also spayed the mountain lion. (Broken bones in the pelvic area obstructed the birth canal and birth of a kitten would have killed her.)

Both animals have been placed back in the wild and have an opportunity to grow and roam free once more.—*H. M. Burrell, Fish and Game warden, Libby*

Raptor Film Now Available

"Spirits on the Wing," a film which explores the world of raptors—eagles, hawks, falcons and owls—is now available. The 30-minute movie was produced, written and directed by Craig E. Sharpe, head of the department's motion picture production unit, with special assistance by Mike Gurnett. Their primary goal was to make available a film that would inform people of the needs of birds of prey and the importance of wise resource management.

As well as delving into the beauty of flight, the movie explains the physical design of various raptors and how this design plays a role in taking food and in other vital activities. The film also explores environmental issues which can either result in extermination of birds of prey or ensure their survival.

It is narrated by Jack Kelly, star of the old "Maverick" television series and more recently heard in television commercials for Löwenbräu. The music was composed and recorded by Jack Sawyer, Kevin Pederson and Michael Durkee of PS Song Writers, Missoula.

"Spirits on the Wing" joins other award-winning department productions, including "In the Hands of Man," a look at the future of Montana's deer populations; "Yellowstone Concerto," a plea for preservation of the free-flowing Yellowstone, and "Room to Live," an exploration of the plight of the grizzly bear in Montana.

To reserve "Spirits on the Wing," free, contact the department's Film Center at 930 Custer Ave. W. in Helena or phone them at 449-2426; prints are also available at regional department offices. Copies may be purchased for $200.

rds Summary

S. DAKOTA		WYOMING		IDAHO		SASKATCH.		ALBERTA		WORLD RECORD			
Weight		Weight		Weight		Weight		Weight		Weight			
lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	Lbs.	ozs.	Year	Place
38	0									56	0	1976	Lock Loma Lake, Mo.
3	5									8	0	1951	Lake Waccabuc, N.Y.
3	4	1	7	2	8					5	0	1957	Santee-Cooper Res., S.C.
2	4½			3	8					4	12	1950	Ketona Lake, Ala.
5	6	10	0	6	12¾	6	2	12	14	14	8	1916	Nipigon River, Ontario
22	3	24	4	25	12	15	8	12	5				
12	3	19	4	14	0								
55	0	22	8	31	0					58	0	1964	Santee-Cooper Res., S.C.
3	5			4	10					31	0	1947	Cowichan Bay, B.C.
		15	0	18	15			8	15	41	0	1925	Pyramid Lake, Nev.
				32	0			25	13	32	0	1949	Lake Pend Oreille, Idaho
36	8									54	8	1972	Nickajack Lake, Tenn.
		11	4	5	2			4	7	11	0	1948	Cook's Lake, Wyo.
						3	2	4	2				
		4	0			4	5	2	15	5	15	1967	Katseyedie River, N.W.T.
				45	0					92	0	1977	Kelp Bay, Alaska
				6	9½								
4	13	44	0			51	10	52	8	65	0	1970	Great Bear Lake, N.W.T.
						11	8	8	8	13	0	1974	Great Bear Lake, N.W.T.
8	12	7	2	10	15					22	4	1932	Montgomery Lake, Ga.
		4	0	5	4			5	4	5	0	1963	Athabasca River, Alberta
35	0	16	12	18	1	42	12	37	8	46	2	1940	Sacandaga Res., N.Y.
118	14												
28	8												
12	8	23	0			18	0	16	7.4	42	2*	1970	Bell Island, Alaska
				23	4								
7	7	6	8					2	6½	8	12	1971	Lake Sakakawea, N. Dak.
3	5¼												
3	1½												
3	7	4	6	6	13					11	15	1955	Dale Hollow Lake, Ky.
15	0	14	4	2	15	14	3	14	10	25	0	1960	Old Hickory Lake, Tenn.
3	9									5	3	1957	Enid Dam, Miss.
				394	0					360	0	1956	Snake River, Idaho
2	5½			2	9.6	2	7	3	10	4	3½	1856	Bordentown, N.J.

*Steelhead—ocean-running rainbow trout

Contributors

The sound of rushing water doesn't have to spell disaster for an early spring fishing trip. In fact, trout *can* be taken during high water by adapting low-water angling techniques. In "High Water: The Fisherman's Friend," **John J. Gaffney** provides some helpful hints for modifying low-water techniques for high-water success. Plus, the recreationist who wants to avoid crowds and heavily fished areas can find solitude and lots of room on Montana streams during spring run-off. In spite of what many fishermen think, these above-average flows play an important part in forming and maintaining channel features that provide habitat for fish and other aquatic animals. Gaffney has been with the Department of Fish and Game for 23 years and is presently the fish and wildlife biologist supervisor at the Research Bureau Laboratory in Bozeman. He holds a B.S. in fish and wildlife technology from the University of Montana, Missoula, and an M.S. in fish and wildlife management from Montana State University, Bozeman. Turn to his article on page 2.

* * * * *

"The Red Fox: A Coat of Many Colors" is in fact an accurate description of a controversial animal: In addition to common yellowish-red to reddish-brown shadings on its coat, silver or black color phases may occur. Yet another color stage called the "cross fox" is fairly common; it is so named because of the black cross formed by a line down the middle of the normally reddish back and another dark line across the animal's shoulders. The red fox wears a coat of many colors, too, because of the different ways it is viewed by farmers, hunters, trappers and others with whom it comes in contact. If a farmer has fields overrun with mice, he may view the red fox as a friend. The trapper may view its pelt, when prime, as a real prize. The hunter with an eye on a favorite pheasant or the farmer who has had a run-in with it in his chicken yard may view the red fox as an enemy. To learn more about the red fox and its friends and foes, turn to **Frank Gjersing**'s article on page 6. Gjersing is a game biologist working in Havre. He holds B.S and M.S. degrees in fish and wildlife management, both from MSU.

* * * * *

"The beds of all these streams are formed of smooth pebble and gravel, and their waters perfectly transparent; in short they are three noble streams. . . ." was the way Capt. Meriwether Lewis described it in July 1805. "This geographic point of mergence and emergence, of ending and beginning, is more than a landmark; it is an ancient focus of man's interaction with man and nature, a goal of exploration and a crossroads of frontier commerce," is the way **Dick Ellis** describes it in his article on page 8. "The Land Where the Rivers Join" is the spot where the Madison, Jefferson and Gallatin come together and merge to create a new force—one of the world's mightiest rivers, the Missouri. Today, the area's history and its recreational potential is marked by the Missouri Headwaters State Park, an area offering fishing, floating, picnicking, interpretive displays and a chance to communicate with the past. In addition to his duties as park manager for the Bozeman region, Ellis has a long-standing interest in North American history and archaeology—interests deeply reflected in his article. He holds an M.S. in wildlife technology from UM.

* * * * *

Montana Outdoors' readers will be pleased to see two articles in this issue with the **Ken Walcheck** by-line. "Marshland Concerto," beginning on page 22, is a record of the sounds and images of a marsh awakening to the yearly clangor of returning waterfowl. It's an unfolding drama of exaggerated courtship displays, erratic flight, the laughter of Franklin's gulls and the whistle of a goldeneye's wings. Special thanks to **Mike Stanish**, Great Falls, for his watercolor which depicts the marsh as having "a solitude as wild and clean and fresh as the most remote wilderness peak."

The article beginning on page 32 is the story of a "Floating Classroom on the Magic Missouri." It's an article Walcheck found easy to write because, since 1972, he has participated as a lecturer in the "floating classroom" sponsored by Northern Montana College. The six-day course focuses on wildlife ecology, geology and Montana history and includes fireside lectures, slide presentations, field trips, hikes, "show me" tours and time for the students to be alone with their thoughts. Walcheck is the information officer for the Miles City region; he holds a B.S. in wildlife conservation and biology from Wisconsin State University, Stevens Point, and an M.S. in applied science (ecology) from MSU.

Each year, spring and its warmer temperatures signal the start of a new tick season that lasts until about mid-July. From now until then, many people who live in—or adventure into—tick-infested areas will be bitten. **Dr. Willy Burgdorfer** has written an article for outdoor recreationists—fishermen, hikers, backpackers, birdwatchers—and others living in Montana's tick-infested areas to familiarize them with the Rocky Mountain wood tick and its role as a carrier of agents causing a variety of diseases. Dr. Burgdorfer urges that recreationists follow some simple precautions and acquaint themselves with initial symptoms of tick-related diseases. "The Rocky Mountain Wood Tick: Beware Its Bite" begins on page 29. Dr. Burgdorfer is head of the Rickettsial Diseases Section of the Rocky Mountain Laboratory in Hamilton. He holds a Ph.D. in medical entomology and microbiology from the University of Basel, Switzerland.

* * * * *

During 1978, 20 pipeline breaks occurred in Montana; in 11 of these incidents, oil or other petroleum-related products reached state waters. As **Ken Knudson** writes, "The impacts of petroleum products on aquatic life, including mammals and waterfowl, are substantial and well-documented. . . ." He concludes that "Oil and Wildlife Don't Mix" and provides some suggestions for locating pipelines to minimize the frequency of breaks, particularly in areas near streams or lakes. Knudson holds a B.S. in zoology and an M.S. in aquatic biology, both from UM. He is the department's pollution control biologist and is currently investigating oil field-related problems in the Cut Bank-Shelby area. Turn to his article on page 37.

* * * * *

This section would not be complete without mention of Danny On and his contributions to *MO*. Over the years, his photographs have provided enjoyment for thousands of our readers; he has enabled them to see Montana's wildlife, wildflowers and scenic beauty through the eyes of an artist. It is only fitting that we should honor his memory with a collection of his own photographs. Turn to page 17, for Danny's beautiful pictures and some fitting words by Louis Kis, a department warden captain in Kalispell, and others who worked with Danny On.

photo of Danny On: Jon Cates

Danny On's Legacy Will Live On

While not everyone in the Pacific Northwest personally knew Danny On, many knew of his wildlife photos. His name was synonymous with the art of wildlife photography. Danny was not one to be outdone by anyone—whether in photography, skiing or in his profession as a silviculturist. A man seeking perfection, yet sensitive to the outdoors. Not only did he know trees, he could properly identify almost any wildflower found from Glacier National Park to Alaska. His wildflower photos are second to none, although wildlife was his main subject.

Danny was a teacher—always ready to help a novice skier, a beginning photographer or to assist in identifying a plant or an animal.

In short, my friend Danny was an intelligent, knowledgeable man, generous to a fault with his time and money, always willing to give of himself. My many trips afield with him will always be remembered.

Many wildlife photographers, including myself, owe much to Danny for whatever success we may attain with our photographs.

Although Danny is not with us any longer, his legacy will live on. You will recognize it in the photos on the following pages and in the photos of the many students he left behind. Danny died on Jan. 21; while trying some great powder on Big Mountain in Whitefish, he fell head-first into a tree well and suffocated. He died as he lived, enjoying the great outdoors.

—Louis Kis, Region 1 (Kalispell) warden captain

"Danny often would pass up a super shot for himself while helping a young amateur photographer get in the right spot for a good shot. Always willing to go out of his way to help others, Danny never hesitated to be of assistance. Many of those people he helped were strangers who he never saw again. But he was generous enough to give his time and knowledge."
—Jon Cates, Missoula photographer

". . . but mostly we regret the loss of his long-term activity in documenting the beauty and ecology of wildlife. We can think of no better way to pay our respects to Danny, and to recognize his dedication to wildlife art, than to hold the 1979 festival in his honor."
—Second Annual International Wildlife Film Festival
Committee; University of Montana, Missoula

"Danny On was a giver and not a taker. He was a generous man who was a perfectionist in everything he did."
—JoAnn Speelman, staff writer, The Missoulian

"On and off the job, Danny gave far more to his organization, the Forest Service, than he received."
—John Emerson, supervisor, Flathead National Forest

Marshland Concerto

by Ken Walcheck
painting by Mike Stanish

IT IS EARLY MAY and the diffused light from distant stars serves as a lantern in guiding us toward a marsh in the glaciated country of northeastern Montana. Shifting black shadows lace the terrain as we wade through a wind-swept sea of prairie grasses. The region's stark beauty almost persuades us that we have been whisked to another planet. As we near the marsh, our destination—a waterfowl observation blind—looms in the dim light, a seeming intrusion on the rolling prairie landscape.

We have sneaked into the blind quietly without disturbing the flocks of birds resting on the bay. A couple of five-gallon pails provide welcome seats as we face the white wake of the eastern horizon. A sense of time lies thick and heavy on the marsh. Since the ice age, it has awakened to the yearly clangor of returning waterfowl and other marshland residents.

I remove a thermos from my rucksack and, as we sit with steaming cups of coffee resting on our knees, the first flush of color tints the scalloped clouds edging the horizon. With notebook, pencil and camera ready, we patiently wait for the curtain to rise on Act 1 of this annual performance.

The show starts promptly at 4:50 a.m. as male red-winged blackbirds sound their zestful "on-ker-ees" announcing their territorial boundaries. As if on cue, other redwings within earshot recite their respective holdings.

From the north, a small band of blue-winged teal—three drakes and a hen—swing over the blind in erratic flight and alight near the reeds at the edge of open water. The courting drakes mill around, shrilly peeping, bowing and bobbing their heads. In a moment, they are up and away again.

A few minutes later, a loud, scolding whine reaches our ears. Suddenly, two canvasbacks, a drake and a hen, whip by at breath-taking speed. The drake heels closely behind the female and as they pass in front of the blind, he catches her tail in his bill, holding on briefly. She turns sharply to free herself, and the drake follows in swift, crowded flight.

Silence again. Before I can note my observations, two gadwall drakes zoom over in close pursuit of a hen. The three twist and turn, rise and fall, like cabbage butterflies over a garden. She quacks loudly, and the males utter whistled calls as they whisk across the marsh.

The various courtship displays we are watching are intricate, individual scenes in a serious and complicated drama. Just as the seasons swing back and forth between the bleak sterility of winter and the green fruitfulness of spring and summer, so also do the lives of birds oscillate between the relative quiescence of the resting season and the impetuous excitement of the breeding season. The extravagant courtship displays that seem so exaggerated to human eyes reflect the special needs of the birds' way of life.

My watch says 5:30 and all bedlam breaks loose. Our cast of performers flashes from one scene to another. A female mallard startles us with her harsh quacks; the male answers with his mellower voice. The laughter of Franklin's gulls and the whistle of a goldeneye's wings pierce the morning stillness. Next, the bubbling, gurgling notes of the long-billed marsh wren drift from weeds in front of the blind. A killdeer flies over, sounding its name. Out on the bay, a garrulous flock of male redheads is splashing and calling hoarse, guttural "carr-carr" sounds, as if the letter R were uttered deep in the throat.

Now the honkers are moving. Out of some far recess of sky, 14 geese head straight toward us, their highpitched honks loud and clear. When the flying wedge disappears, I think of naturalist Francis A. Kortright's tribute: "Sagacity, wariness, strength, and fidelity are characteristics of the Canada goose which, collectively, are possessed in the same degree by no other bird. The Canada in many respects can serve as a model for man."

In a small slough to our left, last year's growths of reeds and bulrushes form a backdrop for the courtship of a pair of ruddy ducks. The drake swims around the female with his fan-shaped tail cocked upright. With a slap of his broad, blue bill against his puffed-up ruddy chest, he pumps out a labored "ip-ip-ip-ip-u-cluck . . . cluck," producing it with such effort that the vertical tail presses forward over his back. When the call is finished, his tail returns to its vertical position.

It's nearly 6 a.m. and still difficult to decide which set of performers to watch. In front of us, two male coots are rapidly backing water with flapping wings. Sitting on their tails, they viciously slash at each other with long, taloned claws. Each tries to protect himself by seizing the feet of his antagonist and thrusting savagely with his white, chicken-like beak. A variety of grunting, croaking and squawking notes which sound like bullfrog plunks accompanies the performance.

On our right, a second set of performers steals the thunder from the coots. Two western grebes swim side by side; they dip their bills into the coffee-colored water and shake them with a rapid clicking. Suddenly, both stand upright, arch their wings, bend their necks in an S curve and spurt ahead on top of the water for 20 or 30 feet—a scene hard to dispel from one's mind.

As the morning sun climbs higher, the prairie marsh seems to float lightly in a world of sky. My watch says 6:15 and a sharp, bitter wind stirs. It signals a brief intermission for our performers and, for us, a departure from the blind. For nearly two hours, these players in a marshland drama have entertained us with sound and image and charged us with excitement and wonder. They have given us a memorable experience and, in our private reflections, we will try to understand the rhythmic patterns in the collective life of the marsh. The experience has reinforced our assurance that there still exists a solitude as wild and clean and fresh as the most remote wilderness peak. ■

M. Stanish
'70

A $10 Challenge

Finding a suitable gift for someone special for $10 or under becomes more of a challenge every day. What about a two-part gift—and one guaranteed to bring enjoyment for an entire year? Give a subscription to *Montana Outdoors* and a binder in which to store the entire year's magazines.

The binder is handsome, a rich brown with gold lettering, and it contains metal rods which hold the magazines securely. It costs $5. Then purchase a subscription to *Montana Outdoors* and fill the binder with timely articles of interest to nearly any reader. A one-year subscription costs $5.

In the next year, *Montana Outdoors* will feature:

- articles on hunting, fishing and outdoor recreation,
- colorful photo essays by Montana's finest photographers,
- life histories and management of key wildlife species,
- articles on Montana's state parks,
- wildlife art by prominent Montana artists and
- "how-to" articles on such subjects as outdoor photography and decoy carving.

And much more!

With graduation just around the corner, Father's Day not far behind and the birthday of someone special approaching, what better gift than a binder and a year's subscription to *Montana Outdoors* with which to fill it?

It's quite a challenge to think of a more pleasing $10 gift.

MY SUBSCRIPTION

Name_____

Address_____

City_____ State_____ Zip_____

One Year ☐ ($ 5.00—6 issues) New ☐
Two Years ☐ ($ 9.50—12 issues) Renewal ☐
Three Years ☐ ($13.00—18 issues)
H379

GIFT SUBSCRIPTIONS

Name_____

Address_____

City_____ State_____ Zip_____

One Year ☐ ($ 5.00—6 issues) New ☐
Renewal ☐
H3X9

Name_____

Address_____

City_____ State_____ Zip_____

One Year ☐ ($ 5.00—6 issues) New ☐
Renewal ☐

BINDER ONLY

Name_____

Address_____

City_____ State_____ Zip_____

_____ No. of binders ($5.00 each)

Make all checks payable to *Montana Outdoors*. Total Enclosure $_____
Send to *Montana Outdoors*, Dept. of Fish and Game; Helena, MT 59601.

Dear F&G

Land and the Problem of Possessiveness

I read with some interest the column on the Landowner Relations Council in your March/April 1979 "Catchall" section. While there are a few points such as the property damage reimbursement proposal which may have some merit, it is my guess that all of this will have little effect on a problem which has plagued Montana hunters since the '40s. In all this time, no practical actions have been taken.

I suspect the major problem is the age-old one of possessiveness: This is *my* land and I want everybody to know it!

Well, I don't happen to think the problem is that simple; with increasing population pressure, it is only a matter of time before the law recognizes that there are definite limits to the rights of property owners. I happen to believe that while I may be a steward of the land and have the right to use it to live on and to make a living with, I have no right to hog it, or to destroy its value for others, as the law now recognizes in the case of air and, in an increasing degree, in the case of water.

Further, I would suggest that if my neighbor's cow strays onto my property, he will certainly believe he has a right to get it back. The game belongs to the people. Why don't they have the right to claim it?

I believe the recreational value of land should be considered a definite, tangible entity, and taxed as such. If a landowner wants to retain the recreational rights to his property, let the tax he pays reflect this. If he wants to let the public use his land for recreational purposes, let the public bear this proportion of his tax. Similarly, leases on state land should be composed of an agricultural worth and a recreational worth, each of which should be a true reflection of the values involved, and each to be leased separately.

Finally, with respect to access to the national forests, while it has been firmly established in the courts that a man has a right to a practical access to his property, the really identical right of the public to practical access to public lands has not generally been so clear. If the Department of Fish and Game really had the interests of recreationists at heart, I am sure it would have long since taken this issue to the courts and promoted the necessary legislation.—*T. D. Perrine, Fox Hill Ranch; Judith Gap, Mont.*

Hunter Safety Instructors Deserve Recognition

As a long-time subscriber to *Montana Outdoors*, I would like to see you feature our hunter safety instructors. These volunteers contribute so much to our future sportsmen. As a widow with a 13-year-old son, I am acutely aware of their contributions.

Our local instructor, Ted Bisch, has been conducting these classes for 21 years. He stresses safety, courtesy and consideration. I am sure there are many like him throughout Montana who deserve our thanks and recognition. Why not let these real sportsmen we take for granted know they are sincerely appreciated?—*Mrs. Fred Hildenbrand; Whitehall, Mont.*

Awesome, Precious Resources

While visiting your beautiful state a few years back, I found the natural and human resources to be awesome. I wanted to learn more of your state and subscribed to *Montana Outdoors*.

The benefits of a quality publication affect not only residents of the Northwest, but touch the lives of everyone. It is comforting to know *MO* is concerned about the level of consciousness and understanding regarding man and his environment.

I thank you for caring about our precious resources. I have enclosed some of my thoughts:

Patterns of Warmth

With the heart of winter quietly passing, a new feeling comes over me.

Day to day changes I see, once more I sense the warmth, the color of the land.

Soils now softened by this warmth of spring, my feet again settle where grasses will soon grow.

From a rigid, firm and frozen state of existence—to this growing, greening, and relentless flowing rhythm.

Trees stretching, becoming heavy with budding growth—grasses drying in the wind, sending roots—filling the air with freshness and life.

Leaves embedded in ice, now freed to drift with the waters, to sink, to die, and to return again.

With the sun now higher in the sky, mounds of snow replenish and awake the thirsty soils.

Earth and cottage settling upon the land, again preparing for the warm rains of April, the hot days of summer.

Woodpile dwindling, melting ice finding its way into the warmth of our cottage—the steady and persistent drip, drip uncovering wrinkles of age.

The revival of plant life, the movement of animals, the song of birds, all contribute to nature's change of complexion.

Tuck away the long underwear, heavy winter sweaters, and wool coats—spring is near once more.

Pack the skis and snowshoes away, remembering the pleasure they've provided.

Not long, and fresh vegetables and fruits will come from the earth, the thought of tending a garden brings happiness.

Canoeing over calm, warmed summer waters, sleeping to the music of crickets and loons while winds gently touch the trees.

Many such places come to mind, others I dream of.

With all senses satisfied, my mind searches for an inner peace. Spring is changes, variety, and so very much beauty.

We can be one with nature.—*Richard Stenerson; Adams, Wis.*

Outstanding Bird Articles

We always enjoy reading *Montana Outdoors*; it is such a beautiful, informative magazine.

Ron Paulick is a member of our Yellowstone Valley Audubon chapter and was an active director before he moved to Fillmore, Utah. His article,

recycled paper

"Winter Fare for Feathered Friends," in your Jan./Feb. 1979 magazine, is outstanding and we wrote and told him so.

"Christmas Bird Count: A Holiday Tradition" by Mike Aderhold, in the same issue, was eagerly read by all of us who have spent many hours "chasing birds" for the annual Christmas Bird Count. The 64-year record of species observed and the Montana map showing the years and where counts were conducted will be referred to again and again. We are grateful to Dr. Clifford Davis who prepared the 1908-73 summary and for Mr. Aderhold's updated map and listing of species through 1977.—*Lila Weber, editor,* Yellowstone Valley Flyer; *Billings, Mont.*

Wild Horse Island, Hunting Questionnaires

Regarding Wild Horse Island (Nov./Dec. 1978), it may be of interest for you to know the state of Oregon has seriously considered turning government-operated recreational facilities over to private lessees, for better control, less damage and vandalism, and cleaner facilities. (Nothing makes me madder than seeing a well-trained, educated ranger cleaning a latrine—which the taxpayer pays for.) In California, federally owned resort facilities are most successfully operated by lessees. They pay the government from 3%-5% of their gross profit and operate according to government standards—actually usually much higher than government standards because they can control operations more satisfactorily.

Regarding your hunting questionnaires, why not issue one with each license? If not returned, that license would not be renewed. The cost would be high the first couple of years, but then you could go back to the way it is now. The licensees would realize it could become permanent if they did not respond.—*Vikki Wolfe; Lakehead, Calif.*

Kilometers Protested

Nice article on the "Powder River: Historical Underdog" in your Jan./Feb. 1979 issue. But what's this I see on the map on page 4? Kilometers? I must protest.

I felt people in the West were *really* free and wouldn't knuckle under to the bureaucracy. A vast majority of Americans reject the metric system. Other than this, everything is terrific.—*Carl Bickmore; South Burlington, Vt.*

Montana Roots

While wintering in Death Valley, Calif., we came across an old friend from Sweetgrass, Mont., who loaned us a couple of copies of your publication.

My wife was very impressed with both issues since her family roots are planted in your state. In 1865, her great grandfather arrived in Virginia City and set up the General Mercantile Store. Her grandfather worked on the Virginia City Madisonian newspaper, then moved to Hardin where he established the Tribune Herald. In fact, even today young and old remember Judge Vickers, her grandfather.

My interest, outside of the fine articles about the state, was your "Editor's Column" in the Sept./Oct. 1978 issue regarding grouse. I, too, spent many of my boyhood days hunting and fishing in Wisconsin. Raised by a sports-minded uncle in central Wisconsin between Marshfield and Wisconsin Rapids, all of our leisure time—of which there wasn't very much—was spent hunting and fishing. And I'll agree—many, many holes were shot in the air while attempting to bag the very swift grouse.—*Robert G. Weber; Death Valley, Calif.*

Meet Edgar

I read the article, "The Pincushion That Waddles," by Ken Walcheck in your Jan./Feb. 1979 magazine. I really enjoyed the picture, but I thought the story could have done more with the porcupine's personality. If Mr. Walcheck would like to meet a real character, we would share our friend Edgar.

Edgar is a small porcupine who arrived at our window three winters ago and stood on the flower box alongside the tom cat and scratched for food. So, our son fed the cat milk and offered Edgar an apple. Now, three winters later, Edgar is still coming and asking for food. He now eats oatmeal and apples.

We go to the door and call him by name and he comes to the door, takes the apple from our hands and looks at the bowl of oatmeal. If this isn't enough to fill him up, he comes to the window and asks for more. We haven't picked Edgar up, but my son has patted him on the head. We have surely enjoyed meeting Edgar.—*Mrs. Dale Black; Cameron, Mont.*

Restricted Waters Equal Proper Trout Management

I enjoy your magazine, but I would like to see more articles about the fine trout streams in your state.

Our streams here in the East have been ruined and I hope you people realize how important restricted waters are for proper trout management.—*David R. Male, Battenkill Bamboo Custom Cane Rods; Shushan, N.Y.*

Editorials

Leave Them in the Wild

Every spring, well-meaning people bring "orphaned" birds, mammals, reptiles and amphibians to Fish and Game offices throughout the state. The comments we usually hear are, "We found it all alone, or "It is hungry and cold."

With reptiles and amphibians such as frogs, toads, salamanders, turtles, lizards and snakes, part of this is true. The young are left to fend for themselves immediately after birth. But with birds and mammals, the reverse is the case. For example, eagle and owl parents feed and take care of their young for as long as 12 weeks. After this, the young can fend for themselves. Many young passerines (or songbirds) leave the care of their parents in about two weeks. In both birds and mammals, parent protection of the young varies with the individual species. In rodents such as shrews and voles, parents watch over the young for about two weeks, but mountain lions and bears look after their young for as long as two years.

Mammals possess a well-developed sense of smell; this sense, along with sight and hearing, enables them to avoid danger.

Young mammals must learn from their parents which sounds, sights and smells are dangerous and when or when not to flee. The young, when they mature, will in turn teach this to their offspring. If a young animal is picked up by unknowing humans, it may never learn these skills. Without them, it has no chance of surviving in the wild. Once in captivity, it can't be returned to the wild without conditioning. Just remember that man can't teach young wild animals what its parents can.

Soon after giving birth, the female deer, elk, moose and antelope moves away from her young. This distance varies with the species and even among individuals of the same species, but she will stay in sight of and will come to feed the young.

If you approach, the adult may behave strangely. It may try to get your attention to distract you from the young; antelope especially exhibit this trait. The adult may also defend its offspring when you approach. This is contrary to most animals' normal behavior because they have learned to stay away from man and try to avoid him whenever possible. In most cases, the adult will run to safety and return later to check on its young. It has not abandoned the babies, but has merely tried to distract you. One of the first things a newborn animal learns is to remain still. So, the young are difficult to spot. If the adult can lure the source of danger away from the young, they will probably be safe.

If you touch a young mammal, your scent remains. When the parent returns, it will probably reject the young animal because of the human scent on it. Thus, by touching a young deer or antelope, you have condemned it to a near-certain death from starvation or the elements.

If you find a baby bird out of its nest, put it back. Research has shown that birds have a poorly developed sense of smell so your scent won't be noticeable to the parents. If you can't find the baby bird's actual nest, place it in another occupied nest. (I call this the "foster bird parent program.") In many cases, the young bird will be adopted by its new parents.

What happens to the animals that come into Fish and Game offices? Some arrive in very poor condition because most people don't know what to feed them or in what amounts. If the animal receives too much or too little food or food of the wrong kind, scours (dysentery) develops. When this happens, the chemical balance of salts, acids and other essential elements in the animal's body is disturbed. A proper balance is necessary to sustain life, so most of these animals die. If we get the animal quickly enough, we can begin proper feeding. If the animal makes it through a critical one-week period, chances are good it will survive.

We try to return all "orphans" to the wild. Certain birds and mammals can adjust from cage life to freedom without trauma, but others will never be able to fend for themselves in nature. They have not learned to secure food or escape danger—so we must place them in zoos. A zoo is not the best home for a wild creature; there is nothing sadder than watching a coyote, fox or bear roaming back and forth in a small cage.

Semitame animals may also hurt humans. On the one hand, they have been fed by humans; but on the other hand, their behavior is entirely unpredictable. So, their adjustment to captivity is unsatisfactory and they also would have a difficult time making it on their own.

When you are out and about this spring, please leave young wild animals alone. If you find a young bird out of its nest, try to put it back. If you see a fawn or calf from an antelope, deer, elk or moose, leave it alone. Remember, once you have touched the animal, it could be doomed. (It is also against the law to pick up and possess any game animal in the state of Montana.) Your intentions may be good, but the ultimate outcome will certainly not benefit the animal.—*Vince Yannone, assistant chief, Conservation Education Bureau*

A Different Drummer in the March of Progress

• *This editorial was adapted from a guest editorial appearing in the Great Falls Tribune Progress Edition, Feb. 20, 1979.*—Ed.

* * * * *

Few people take exception to the concept of progress. To most, it still means getting bigger and having more material wealth. Growth is good, more is better and bigger is best are still the "in" cliches as "progress" in its traditional connotation is pursued by our society.

This edition of the Tribune pays homage to progress in the biggest paper published each year. Few readers question the message or philosophy. Possible exceptions are paper carriers burdened by its weight and those responsible for preserving the state's fish and wildlife. Those of us engaged in the latter endeavor are apprehensive because history has taught us that both fish and wildlife diminish as progress in its traditional form consumes land and other resources to accommodate development and growth.

To hunters, fishermen and other recreationists, traditional "growth" patterns not only mean less country in which to roam, but also more crowding in the field. More and more big game hunters spot the blaze orange of another hunter in the aspen grove instead of the anticipated big buck or bedded elk. To fishermen, progress means boot tracks near a favorite fishing hole where before the sand was tracked only by mink or herons. To the camper, it means backcountry lakes with four or five tents pitched nearby where moose or elk used to be seen.

Montana is changing. That change is already perceived by sportsmen and recreationists, possibly before traditional circles of economists and bankers have noted it. Probably the major force effecting that change is the national drive to develop domestic energy resources, primarily coal. To its credit, Montana—more than any other western state—is struggling to control that change. If Montana succeeds in controlling energy-related change, it will not only be better for fish and wildlife, but also better for the people who will live here in the future.

Although energy growth is a recent and current event in this region, some comparisons already can be made. Wyoming, similar to Montana in many respects, has not been as demanding of those developing energy reserves in that state. ElDean V. Kohrs, clinical director of Wyoming's Counseling Center, wrote in a paper presented in 1974: "The history of power production—synonymous with 'boom development'—in Wyoming is a dismal record of human ecosystem wastage. Frontier expansion without adequate planning has left cities crippled by shameful environments which cause human casualties."

Kohrs continued, "Since the first oil was found at Salt Creek, power production in Wyoming has wreaked a toll of human suffering, development communities that flared in the boom blaze and died, or flared and continued wildfire growth without care or planning, leaving wakes as devoid of quality life support as a prairie grass burn area."

A New York Times writer, reporting from Rock Springs, Wyo., site of a new power plant, said in 1974, "Now Sweetwater County is a high-priced rural ghetto. It is hard to

find anyone who likes it here. People are constantly moving in for high-paying construction jobs, then moving out because they cannot stand the living conditions. Job turnover rates average 60 to 80 percent a year."

Fred Eiserman, fishery resource manager for Wyoming, wrote, ". . . the people in Wyoming who enjoy the outdoor world of hunting and fishing have been in clover up to their belt buckles. Well, it is just about all over now, the old way that is. The free or almost free lunch is gone. For you and me, the average Joes, it will mean less elbowroom on our favorite streams or lakes, or perhaps your favorite fishing water will not even be available because of locked gates. You can also bet a good many of those fall aspen patches will contain another hunter instead of the fat mule deer buck that you have so often anticipated in the past. I believe a mirror image of our future can be obtained with a look at California."

What has been related above is not true for Montana. It is not true at Colstrip. With luck, it will not be true anywhere in Montana.

In May 1978, Carl Bagge, president of the National Coal Association, addressed the Rocky Mountain Coal Symposium. News accounts quoted him as saying, "Montana—with its oppressive coal severance tax—is the one flaw in the otherwise bright future of Western coal development."

His talk was titled, "Western Coal—A Resource in Bondage." But only in Montana, he said, is that really true. "Is our coal a resource in bondage? Certainly not in Wyoming, Colorado or New Mexico," he said. "Only Montana marches to the beat of a different drummer."

There's a message in all of this: When development—"progress"—is unrestricted, it is not only bad for fish and wildlife, but also for people and possibly even for those who pursue growth and progress blindly. Once again, the welfare of fish and wildlife has a direct bearing on—or at least is an indication of—our own welfare. Progress is positive only if in the process of pursuing it, we also preserve those things of real and enduring value such as fish, wildlife and the wild places necessary for their survival.

Henry David Thoreau once wrote, "A man is rich in proportion to the number of things he can afford to let alone." It is an interesting thought to keep in mind as we pursue progress. Perhaps the "different drummer" Carl Bagge bemoans is striking the proper beat.—*Jim Posewitz, administrator, Ecological Services Division*

How to Avoid Application Pitfalls

Each year, many sportsmen complain about the complexities of the computerized drawings and application procedures they must go through to obtain a special permit or license to hunt moose, goat, antelope, special deer, special elk and "limited" sheep. Inevitably, some sportsmen fill out the application form incorrectly and are thrown out of the drawing as a result. Why does this happen? Can it be avoided?

In an attempt to solve the problems, the special licensing staff has put together a list of the most common errors that will result in an application being rejected. Sportsmen should avoid them like the plague.

The deadline for making application for the above-mentioned special permits or licenses will be June 15, 1979. Applications not properly postmarked or received by the department by June 15 will not be considered.

To be processed in any drawing, each application must include the following vital information: (1) the proper fee, (2) signature, (3) birth date, (4) conservation license number, (5) hunter safety number (applicable if the prospective hunter is 17 years old or younger), (6) name and (7) address.

Sounds simple, right? Wrong.

Last year the most common errors on the application forms received by the department were: (1) no signature, (2) no conservation number, (3) no birth date, (4) no fee or an incorrect amount and (5) no hunter safety number when required.

In addition to these common errors, consider the following oversights, which also can cause an application to get bounced out of the drawing process: (1) failure to mail party applications (those planning to hunt in the same group) in the same envelope (an application for each hunter and the appropriate fee for each application must be included), (2) failure to include elk tag and/or deer tag numbers when applying for special deer or elk permits, (3) no preference slip for applicants claiming preference, (4) no evidence that a prior moose, sheep or goat tag was not used, thus making an applicant ineligible until after the seven-year waiting period (this year, the department will accept only the original unused tag as evidence that a hunter was not successful) and (5) incorrect hunting district numbers and/or season types.

Many hunters have asked why a season type number is needed. In computerized drawings, this number is needed to indicate a specific combination of bag limits and hunting dates.

But we're not through with possible problems yet. For instance, if you write an insufficient-funds check, you will automatically be eliminated from the drawing process. Changing your address, cutting your application into several sections and mailing them individually, or checking landowner preference when it really doesn't apply can slow the processing of your application to a turtle's pace.

The goal of the special licensing staff is to eliminate errors so that applications can be processed as quickly as possible. When an error is discovered, the application is sent back to the applicant, along with an explanation, so the error can be corrected and the application returned before the June 15 deadline. But consider the plight of the special licensing staff: In 1978, the department received 57,302 applications; 51,800 of these came in on June 15 and 16 (with a June 15 postmark).

No doubt about it, the drawing requirements are complex—five-year preference for some species, seven-year kill restrictions on moose, sheep and goat, hunter safety and conservation license number requirements, party application restrictions, a 10% quota for nonresidents for each district, etc. But such a huge work load in two short days makes the special licensing staff's job nearly impossible.

Obviously, your odds of breezing through the drawings are better if you make no mistakes on your application. But if you do make a mistake, the odds of straightening it out before the deadline will be much better if you apply early.

If you have questions about your application, call the special licensing staff (toll-free) at 1-800-332-6109. The number will be operating from 8 a.m.-5 p.m. Monday through Friday from May 15-Aug. 31.

Remember, this procedure applies only to those who want to obtain a permit or license to hunt moose, goat, antelope, special deer, special elk or "limited" sheep. ("Unlimited" sheep districts are those where licenses are sold over the counter until Aug. 31; check with Fish and Game for special regulations applying to this type of license.)—*M. Ann Miller, news coordinator*

The Rocky Mountain Wood Tick: Beware Its Bite

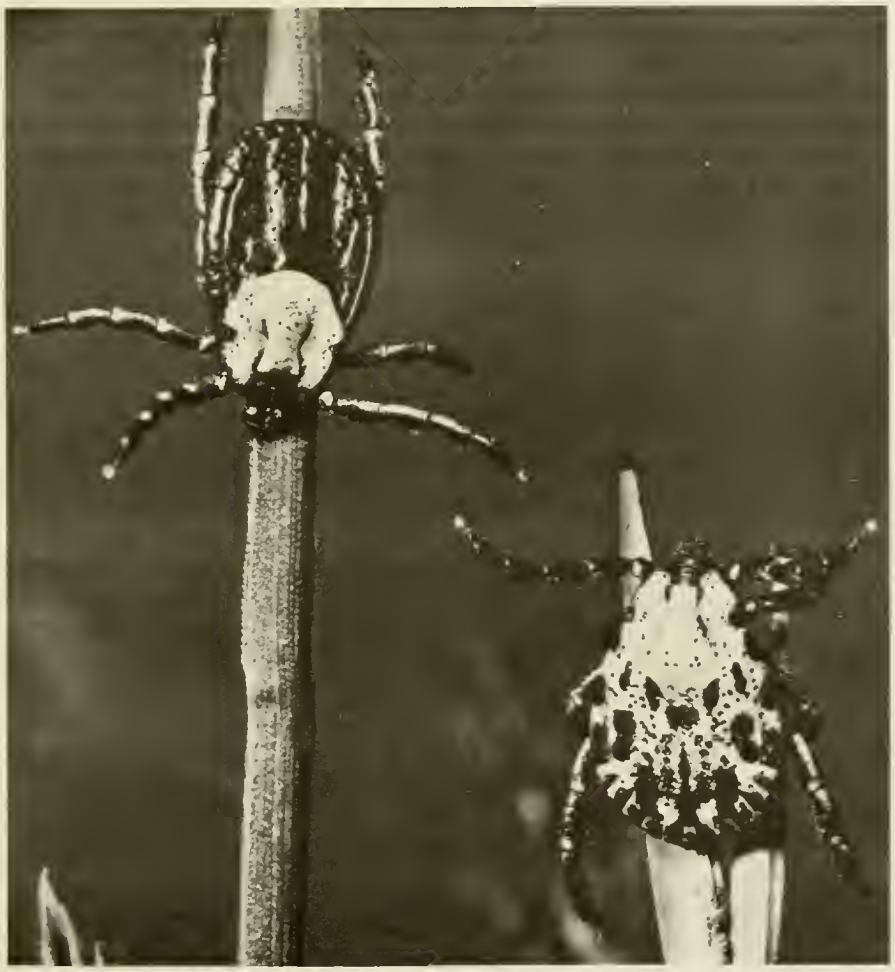
by Dr. Willy Burgdorfer

EACH YEAR, the onset of spring with its warmer temperatures signals the beginning of a new tick season that lasts until about mid-July; then hot weather and low relative humidity again force the adult tick to become inactive. Thus, during the next few months, thousands of Americans who live in—or adventure into—tick-infested areas will become victims of tick bites. Unfortunately, some of these will lead to febrile illnesses (those accompanied by fever) that if unattended or misdiagnosed may result in complications or even death.

The following article was written for outdoorsmen (fishermen, hikers, backpackers, birdwatchers) and for others living in Montana's tick-infested areas, in an effort to familiarize them with the Rocky Mountain wood tick, *Dermacentor andersoni*, and with its role as a vector (carrier) of agents causing Rocky Mountain spotted fever, Colorado tick fever, tick paralysis and tularemia.

The Rocky Mountain wood tick, *D. andersoni*, occurs in the mountainous regions of the western United States and the southern parts of British Columbia, Alberta and Saskatchewan. The tick is particularly abundant in areas where small rodents share habitats with large wild and domestic animals. It is not host-specific, i.e., any animal except birds may serve as blood donor.

Larval (''seed ticks'') and nymphal stages feed on small mammals, particularly rodents, rabbits and hares; adults feed on large wild and domestic animals such as cats, elk, deer, bears, cattle, horses, goats, sheep and dogs, and accidentally also on man. Occasionally nymphal ticks will also feed on man.



As soon as the snow begins to melt, adult ticks emerge from hibernation and climb to the tips of low vegetation. Activated by the odor and breathing of a nearby host, they remain attached to the vegetation by their third pair of legs, but stretch out the other legs in searching motions, ready to transfer to any animal or man brushing against them. A female and male wood tick, Dermacentor andersoni, *are pictured above.*

The tick has a two-year life cycle with spring and early summer being the feeding periods for the adults. After a feeding, which lasts from seven to nine days during which mating occurs, a female may lay up to 7,000 eggs that hatch after about 30 days of incubation. Larvae feed on small rodents during the summer and then develop into nymphs. The nymphs generally crawl into hiding until the following spring when they, too, feed on small rodents. After they are full, they drop, hide and develop into adults. Usually, adults take a blood meal about eight to 12 weeks after they emerge from the nymphal stage. Thus, most of them will again hide under debris or near the surface of the soil until spring of the following year.

As soon as the snow begins to melt, adults come out from hibernation and climb to the tips of low vegetation (see photograph). Activated by the odor and breathing of a nearby host, they remain attached to the vegetation by their third pair of legs, but stretch out the other legs in searching motions,

ready to transfer to any animal or man brushing against them.

When you're in an area likely to have ticks, wear proper clothing. Don't wear shorts or short-sleeved blouses or shirts. Instead, wear clothing that fits tightly at wrists, ankles and waist. Each outer garment should overlap the one above it—cover trouser legs with high socks or boots and tuck shirt tails inside trousers. Since contact with ticks cannot be prevented, repeatedly search the body, especially the hairy regions and inside clothing, because ticks seldom attach within the first few hours.

Insect repellents containing diethyltoluamide and/or dimethylphthalate provide some protection against ticks.

Immediately remove any tick that may have become attached. You can do this with your fingers (preferably with forceps), but be careful not to crush the tick because tick juices or tick tissues contaminating the wound can cause infection. Grasp the tick as close as possible to the point of attachment and pull, *gently* and repeatedly. Don't try to jerk it loose since mouth parts will often break off and remain embedded in the skin. Treat the bite wound with an antiseptic and wash your hands thoroughly with soap and water. Don't attempt to remove ticks by burning them with cigarettes and matches; you can suffer severe and painful burns.

After removing the tick, don't kill it or throw it away. Instead, place it in an empty pill bottle or other small container; then record the dates of tick exposure and removal on a small piece of paper and moisten it, placing it inside the container. If you experience general malaise with fever, headache and muscle pain within two weeks after tick removal, consult a physician immediately and provide him with the tick and exposure dates. This information will help him with his diagnosis and treatment.

Occasionally, tick bites go unnoticed. Therefore, if you live in or visit tick-infested areas, become familiar with at least the most important clinical features of Rocky Mountain spotted fever, Colorado tick fever, tick paralysis and tularemia.

ROCKY MOUNTAIN SPOTTED FEVER

Rickettsia rickettsii is a microorganism which lives in 1%-3% of ticks as a parasite. It is transmitted to man or animals by the tick's bite. From two to 14 days after transmission, there is a sudden onset of severe headache, chills, general aching, nausea and fever. A rash appears between the second and sixth day of fever and characteristically begins on wrists, ankles, palms, soles and forearms. It later extends to buttocks, trunk, neck and face. In untreated patients, fever begins to decrease by the end of the second week, but complete recovery requires weeks or months. When the disease is fatal, death usually occurs near the end of the second week.

". . . children and women in the eastern and southeastern parts of the United States are more likely to contract spotted fever because household pets, particularly dogs, are infested with the tick that carries the disease agent."

Early diagnosis of spotted fever based on symptoms alone is difficult. However, this diagnosis should be considered if fever, chills, headache and muscle pains are observed in a person who has been exposed to ticks or has actually been bitten. Development of a rash, especially if it appears first on the palms and soles, is indicative of Rocky Mountain spotted fever. The person should be immediately treated with appropriate broad-spectrum antibiotics, to which most persons affected with spotted fever respond well. Any delay in treatment could lead to serious complications, even death.

Before 1930, Rocky Mountain spotted fever was thought to occur only within the Rocky Mountain region. Since then, the disease has also been found in most eastern and southeastern states where the American dog tick, *Dermacentor variabilis*, carries the disease-causing parasite to man. From 1938-48, about 500 cases of spotted fever were reported annually in the United States, with an average fatality rate of about 20%. These figures decreased sharply after introduction in 1948 of the broad-spectrum antibiotics, chloramphenicol and tetracycline.

However, in 1960, the disease rate again began to increase and has continued to do so, especially in the eastern and southeastern states. In 1977, 1,115 cases with 42 deaths were recorded nationwide, representing the highest number of cases ever recorded. Although nearly all persons afflicted with spotted fever recover when properly treated with antibiotics, fatality rates from 2%-10% have been reported for the past 20 years. Most of these deaths occurred because patients did not seek proper medical care, the disease was not recognized or specific treatment was delayed.

In the Rocky Mountain region, the annual incidence since 1910 averaged about 248 cases until 1944 when the number sharply dropped to 65; far fewer than 100 cases have been reported annually ever since and they represent a relatively small proportion (1%-2%) of cases reported nationwide.

The decline in the Rocky Mountain region and the alarming increase in the eastern and southeastern states appear to be related to differences in the patterns followed to control the disease. In the Rocky Mountain region, spotted fever was (and still is) primarily contracted by adults who work or recreate in the outdoors and who become part of the natural cycle of *R. rickettsii*. Once the land was cleared and cultivated and tick control measures (area control, rodent extermination) were begun, the number of cases decreased.

In contrast, children and women in the eastern and southeastern parts of the United States are more likely

to contract spotted fever because household pets, particularly dogs, are infested with the tick that carries the disease agent. In addition, changes in land use (people moving to the suburbs, cultivated land being allowed to revert to forest for recreational use) and anti-pollution laws preventing "spring burning" result in more possibilities for human contact with areas where *R. rickettsii* thrives. Such land use practices also create and maintain new tick habitats. Improved surveillance and better reporting by physicians and health departments could also account for increased incidence.

In the Rocky Mountain region, the present trend should not change as long as the disease continues to strike those engaging primarily in outdoor occupations. However, more campsites and recreational areas and even more important, man's encroachment into the natural habitats of *R. rickettsii* through building homes near or within forests, may again lead to increased incidence. In Montana, 71 cases of spotted fever have been reported to the Montana Department of Health and Environmental Sciences during the past 25 years. The last fatal case was contracted in the Bitterroot Valley in 1975.

Until about two years ago, a commercial vaccine was available for the protection of persons living in areas where Rocky Mountain spotted fever was prevalent. Since this product offered only limited protection, it was withdrawn from the market; at present, there is no commercial source of a vaccine. A more effective vaccine is under investigation and may become available for distribution.

COLORADO TICK FEVER

Colorado tick fever (CTF) is caused by a virus transmitted to man by the bite of an infected adult, *D. andersoni*. From three to five days later, those bitten suffer chills, headache, muscle aching and fever that may range from 102°F-104°F (39°C-40°C) for two to three days. Then, the fever usually subsides for a day or two and a second fever period of similar length occurs. Some patients may develop a faint, but transient, rash; in children, the central nervous system may be involved. CTF usually does little harm and most patients recover a few days after the fever subsides. In older persons, however, full recovery may take several months. Treatment involves medication to control muscle aches and headache. Because the disease is relatively harmless, many cases never come to the attention of a physician and, if they do, they may not be recognized as CTF. In Ravalli County—a 2,300-square mile area with a population of about 22,000—11, 26, 24, 19 and 20 cases were recorded in 1973-77, respectively. The high prevalence of CTF may be explained by the high rates of infected ticks (up to 40%) in certain locales, and by the fact that even temporary attachment of an infected tick usually results in transmission of the virus.

TICK PARALYSIS

Tick paralysis in the Northwest occurs sporadically in man (mostly children), livestock and wild animals and is caused by females of the wood tick, *D. andersoni*. The exact nature and origin of the causative agent is unknown, although a toxin (poison) is believed to be involved. Ticks causing tick paralysis may attach themselves to any part of the body, but they are usually found on the scalp, at the back of the neck, in the ears and in the hairy genital regions. Difficulties in walking—such as weaving or staggering—are usually the first signs of the disease. Within hours, the person afflicted becomes uncoordinated and his hands and feet become numb. Paralysis occurs, involving also the respiratory and throat muscles. Speech becomes difficult and finally impossible. Death from respiratory paralysis usually occurs in three to five days. If the tick is removed before the respiratory muscles are too severely involved, improvement is common within one hour and complete recovery follows in one to five days. If you suspect a person of having tick paralysis, *carefully search* the person for ticks, including the rectal and genital regions, ears and scalp.

Tick paralysis is not one of those diseases reported to health officials, so there are no records on the number of recent cases. Up to 1950, 113 cases had come to the attention of the Rocky Mountain Laboratory in Hamilton. Fifty-two of these occurred in Montana, and the rest in Idaho, Washington, Oregon, Colorado and Wyoming.

TULAREMIA

The wood tick, *D. andersoni*, is the only important carrier of *Francisella tularensis*, the agent that causes tularemia in man and domestic animals in the Rocky Mountain region. Depending on where the infectious agent enters the body, various symptoms appear. The tick-borne form of tularemia, also referred to as the ulceroglandular type, is characterized by a lesion or sore at the site of the tick bite. This lesion then progresses to a tissue-destroying ulcer, accompanied by swelling and tenderness of the regional lymph nodes. A person with untreated ulceroglandular tularemia could have a fever for three to five weeks. Convalescence may take several weeks or months and often is accompanied by weakness and spells of fever. Before effective antibiotics, the fatality rate was about 10%. However, with the introduction of streptomycin and tetracycline, mortality has decreased to less than 2%. In Montana, only 12 cases of tularemia have come to the attention of the Department of Health and Environmental Sciences during the past 10 years.

CONCLUSION

Because education is the best means for preventing tick-borne diseases, the public must be reminded that Rocky Mountain spotted fever, Colorado tick fever, tick paralysis and even tularemia are by no means "historical curiosities." They are diseases whose agents are still maintained and distributed by the wood tick. Therefore, if you venture into tick-infested areas, follow the precautions recommended above and familiarize yourself with the initial symptoms of these ailments. If you are bitten by a tick, do not panic or become alarmed, but consult a physician *without delay* should illness occur. ■

Floating Classroom on the Magic Missouri by Ken Walcheck

WHEN THE COTTONWOODS in eastern Montana start shedding their fleecy seeds, a restlessness stirs within me, and I think about a unique area in north central Montana that seemingly can transport me into the past. A place of retreat where the colors of the long ago haven't faded very much. A place where mundane problems are viewed from the perspective of the soaring eagle, the timelessness of the river and the tranquility of evening twilight.

It is during this period of late spring that the pangs of becoming a "river rat" surge through me and I impatiently await my return to the Missouri River Breaks. Although I have floated the Missouri many times, the magic never fades. But like first love, the first encounter can never be repeated—and nothing can prepare you for it.

Since 1972, I have participated as a lecturer in Northern Montana College's outdoor recreation Missouri River float trip. The six-day course focuses on wildlife ecology, geology and Montana history.

As a classroom, it is difficult to improve on the Missouri River and its associated breaks. The 149-mile stretch of river extending from Fort Benton to the Fred Robinson Bridge received official designation as part of the National Wild and Scenic Rivers System in 1976. The area offers notable associations with the Lewis and Clark Expedition and other historical events such as westward expansion and development, the fur trade, the gold rush, Indians and military affairs, river navigation and the colorful era of the river steamboat.

And there is much more. This stretch of the Missouri contains what is probably the most striking scenery of its 2,500-mile course, scenery which elicited glowing descriptions from Meriwether Lewis and was captured on canvas by the brush of Swiss artist Karl Bodmer in 1833. Geologically, it tells a fascinating story of a disarranged drainage and the cutting of a new river course during continental glaciation. Archaeologically, the area possesses many sites representing the aboriginal culture of the Plains Indians. Paleontologically, the area contains a rich and varied graveyard of fossils dating back to the Cretaceous Period. In terms of wildlife, a diverse corridor of habitats provides for a wide array of plant and animal species.

Near the top of the Hole-in-the-Wall formation (F&G photo: Ken Walcheck)

Limited to 20 students, the floating workshop comprises a broad spectrum of people ranging from teachers and students to "outsiders" such as ranchers and physicians. The workshop encourages provocative exchanges and informal discussions with the instructors. There's also sufficient time for individual pursuits such as photography, swimming, exploring or simply appreciating the aesthetics of the area.

Canoes are launched at Coal Banks Landing, a Department of Fish and Game recreation area 42 miles downstream from Fort Benton. Accompanying the "Corps of Instruction" is outfitter Nick LaFrantz and his picturesque houseboat which serves as a galley and repository for the students' gear. LaFrantz is a rugged, colorful individual brimming with anecdotes about the breaks area. No doubt, he would have been at home in the company of Lewis and Clark, Jim Bridger, Hugh Glass, John Colter and a host of others. And, as an outdoor chef, he's pretty hard to beat.

Before the trip begins, Tom Nielson, float leader and assistant professor of Health and Physical Education at Northern Montana College (NMC), gives a short lecture on canoe basics. In short order, paddles are flashing in the sun and biting deep into turbid waters, bows heading for the Fred Robinson Bridge over 100 miles downstream. I'm always impressed with the knowledge Nielson transfers to the students. Some have never held a canoe paddle, but at the end of the trip they are using the "J" stroke with real precision.

When the canoes reach the White Rocks Area, a sedimentary sandstone formation, the group unites for the first of a series of floating lectures. They are unique—I can think of no course that presents lectures in this way.

As the canoes drift below great formations towering over 100 feet, past long galleries of eroded white sandstone, through formations crowded with slender cylinders and pierced with dark dikes, we are primed for the forthcoming lecture. In such a place, the break from civilization becomes complete and involvement with the river is intimate and you move together as one.

Many of the striking geological formations have names. Some seem appropriate, but many bear names that interpret the world in terms of human values and experiences—titles that seem incongruous with the sweeping scenery of the Missouri River Breaks. Some floaters delight in identifying these formations, but they seem to take little else from the river. We do not emphasize the names; it is not because we wear cultural blindfolds, but we would rather the students appreciate and understand *how* these ancient sea beds were created and sculptured over the eons by wind, water and other geological forces.

Float lectures, as presented by Harrison Lane, professor of history at NMC, are colorful and inspiring. Lane is the sort of speaker who can

repopulate the landscape with river travelers from the distant past. When he speaks of the Lewis and Clark party's upstream trek through the breaks area, you can picture the explorers struggling in chest-deep cold water, floundering and straining in shoreline mud or laboring over banks of shale and sandstone as the men pulled their two large pirogues and six canoes upstream.

A lecture by Lane on Chief Joseph and the Nez Perce grows in the mind's eye and one can picture spirited Appaloosa ponies splashing across the Cow Island ford toward a small group of entrenched riflemen; one can almost hear the hammering Springfields and the sharp whine of bullets cutting the air.

Fireside lectures are presented at each evening campsite and subjects range from the early steamboat traffic to energy developments and environmental concerns in Montana. We carry a portable generator on the houseboat—which to some might not seem appropriate—but it enables us to show slides which add further color to the evening presentations. During the evening talks, I like to sit next to a cottonwood and watch the river slide by. If conditions are right, a gentle breeze blows from the southwest, rustling broad cottonwood leaves. With closed wings, nighthawks swoop down in steep dives; at the end of the dive, their wings are thrown open and forward, making a sound like someone plucking a large rubber band. Such sounds are not distracting. Rather, they make the evening topic far more meaningful.

After several days on the river, our floating classroom starts to appreciate the value of this area as no stranger can. It's a place one can encounter a haunting and serene quiet unlike any previously experienced, a place where we start to feel at home with ancient and mysterious rhythms, a place where a biting wind squall whipping across the river matches our determination to blend in with the environment and a place that offers a museum of complexities too mind boggling for our faculties to comprehend. Romantic, perhaps—but realistic, too.

Like all trips with a new group, it takes a few days before the students meld into a cohesive unit. I have never heard a single individual complain about some of the minor hardships. Once I watched a student step from her canoe into a muddy quagmire that engulfed her up to her waist. As she struggled to free herself, her mud-spattered face suddenly broke into a wide grin which pretty well expressed how she felt.

Most of the instruction emphasizes field trips. For example, there's the Hole-in-the-Wall hike. After listening to a fireside lecture on the geology of the Missouri, we hike to the top of a long ridge adorned with turretlike formations and with a "window" at one end. Standing on top of the formation, we are exposed to a wild confusion of terraces where centuries of erosion have produced a fantasy of color and shape. "Scenes of visionary enchantment" was the way Lewis described the White Rocks Area in 1805; in 1979, his description still holds.

Last summer, I walked to the end of the narrow, leading edge of Hole-in-the-Wall with a student. It's a place where gravity pulls at your soul, and distance, depth and time seem infinite. As we stood above the "window," strong westerly gusts of wind made our position precarious. I have stood in this precise spot many times before, but never have I felt the terminal portion of the rock vibrate as it did that day. The student—with blue eyes flashing and voice bristling with excitement—summed it up best: "That 60-second exposure was one of the most exhilarating experiences of my entire lifetime."

Hole-in-the-Wall and the surrounding white cliffs are synonymous with fragility. Composed of soft, sugary sandstone, these stony "draperies" have been assaulted by wind and water; they are laced with spindly structures which crumble like centuries-old paper. If river traffic continues to increase—as it surely will—some erosional masterpieces could be reduced to the original silicon particles laid down millions of years ago. Also, graffiti become more evident each year at Hole-in-the-Wall.

During our short stay, we set a couple of gill nets to sample some of the 49 fish species found in the Missouri. Most of the students have never seen a gill net before and they enthusiastically pitch in to help set the nets and pick them of fish the following morning.

When the flotilla reaches the mouth of the Judith River, the "Land Expedition" strikes out for Camp Cooke to explore the site of Montana's first military establishment. Only by actually visiting such a site can one visually reconstruct and understand history. Lane recaptures the aura of the past as no history book can when he speaks of the purpose of the fort, its marginal quarters, the frequent desertions and the Indian skirmishes. The same site in 1979 is a vacant stretch of sagebrush; the only sound, that of the wind; the only movements, those of the Judith River gliding by and a flock of stately herons using a nearby rookery. The soldiers are gone, but the buried fragments of iron, glass and leather attest to their presence.

Other field activities at appropriate sites include electrofishing demonstrations, early morning bird hikes, a lecture on island dynamics which compares the Missouri with a free-flowing Yellowstone, a trip to the Cow Island rifle pits and a look at some graffiti left on a sandstone bluff by the crew of the U.S.S. Mandan, a government snag boat which operated on the upper Missouri more than 80 years ago. Spontaneous "show me" trips are also woven into the course. Students can examine old homesteads, Lewis and Clark campsites, woodhawkers' graves, prairie dog towns, geological formations and fossil sites.

The abundance and diversity of wildlife in the breaks have been noted since the days of Lewis and Clark and the 1833 Maximilian Expedition. Presently, 60 species of mammals, 233 species of birds, 20 species of amphibians and reptiles and 49 species of fish inhabit the upper Missouri and scenic river area. With its diverse wildlife habitats, the river seemingly acts as a magnet, attracting birds from the sky and animals in from the high plains on every side.

The cast of wildlife characters has some gaps. The sandstone and shale cliffs above the river once abounded

with Audubon bighorn sheep; cottonwood and willow groves held grizzlies, and the open bottomland flats teemed with elk and bison and even harbored a few wolves.

Wildlife lectures centering on big game, waterfowl and other species are presented along appropriate stretches of the river. This part of the course is particularly frustrating for me because there is so much to talk about and to see, yet the scarcity of time permits us to cover only a few topics. At the end of each float trip, I think, "Next year, we'll. . . ."

After a couple of days on the river, most students, regardless of their backgrounds, realize the breaks area is rich in prehistory. It's an insight difficult to dispel because everywhere there is mystery surrounding past aboriginal occupation.

What was the origin of the paleo-Indian or the early big game hunter of the Pleistocene Epoch?

Which tribes utilized the benchlands above the river?

Why did they camp on the benchlands rather than closer to water on the river?

Were there permanent residents along the river or was it a migration route for tribes following the bison herds that swarmed over the plains of eastern Montana?

Although no intensive survey of the Missouri Wild and Scenic River Area has been made, more than 170 documented sites testify to aboriginal occupation. They provide evidence of temporary camping areas, an evolving Stone Age technology, sources of subsistence, ceremonial performances and burial practices.

Several years ago, we floated around a bend in the river and ran into Dr. Leslie Davis, professor of anthropology at Montana State University. He and some of his students were conducting an archaeological survey under a permit and contract issued by the Bureau of Land Managment. One of the group's more interesting finds was a canine skull, facetiously dubbed "Phideaux," by the students. Davis explained that 500-700 years ago, a "domesticated" canine was living the life of a camp dog in the prehorse, Plains Indian culture. It was a dog's life at best, and it ended when a club bounced off the animal's skull and it wound up in the pot. This particular skull, with a noticeable cavity, ended up as an artifact in collections held at MSU depicting life centuries ago on the Missouri.

It seems a bit of humor always manages to slip into the trips. For example, the "Caroline incident" still causes me to chuckle. Caroline was a physical education instructor who was in excellent shape and, in my opinion, would have been an excellent decathlon candidate for the Olympics. One afternoon, she paddled her canoe up to our 16-foot, jet-powered craft and asked our fisheries biologist if he would like to try his hand as a canoeist. Without a trace of hesitation, he cleared the gunwales and manned a paddle. As we left them behind, I could see this canoe was not going to run a true course. Actually, it looked like a whirligig beetle as it gyrated all over the river. Our biologist was taking three strokes to every one of Caroline's and he still couldn't match her strength. After watching the canoe zigzag back and forth, we moved closer to the canoe and heard an urgent, "Hey! I want to get back in the boat. NOW!"

We cupped our hands to our ears, pointed to the motor and pretended we couldn't hear. With a shrug of our shoulders, we headed downstream. About half an hour later, we moved back upstream to the canoe and were greeted with,

Using a portable backpack fish shocker (above), Al Elser, fish manager for the Miles City region, conducts an electrofishing demonstration for students participating in Northern Montana College's annual course on the Missouri River (F&G photo: Ken Walcheck). A restful break along the mighty Missouri, with outfitter Nick LaFrantz's houseboat serving as galley and repository for students' gear (photo: Tom Nielson).

"HEY! I'M NOT KIDDING. I WANT OFF THIS THING AND RIGHT NOW!"

Caroline paid no attention to him and her paddle seemed to bite deeper into the water. Again, we feigned hearing difficulties and surged downstream. As I turned around for one last look, I saw a paddle held in what I would call a threatening posture, and I swear I could hear a series of epithets I had not heard for a long time.

When the two canoeists reached our campsite late that evening, I never could quite understand why our exhausted colleague wouldn't talk to us, especially when Caroline was in such good spirits.

How does one measure what a student receives from a course such as this? You can't. When I first started participating, this question disturbed me and I racked my brain searching for an answer. It took several trips before I realized the answer was really quite simple: No test or computer can truly measure the knowledge and impressions a student gains. Regardless of a student's interests, I'm certain this experience enhances and expands the participant's outlook on the direction, intensity and future of Montana's environmental concerns.

During my numerous float trips down the Missouri, I have walked and boated many miles and seen, heard and felt mysterious and rare things. The difficulty in assessing such aesthetic experiences, however, soon becomes obvious. When we attempt to describe something as grand as the Missouri River and its breaks, we are all—from astute biologist to professional natural historian—trying to describe phenomena beyond our powers of expression.

One of my sharpest memories of one summer was waiting with several students for the correct moment to photograph two golden eaglets in their nest. We were poised on the face of a cliff, one eye on the birds, the other on the sky, watching tensely for a break in the drifting clouds. But perhaps not even our final photograph can record the wonder, beauty and drama of the moment.

Other phenomena were viewed in comparative comfort. A pillar, rising in a field of white, fragile sandstone next to a large cottonwood grove, was designed by nature as a backrest for several people. While using the rock for that purpose, we witnessed a spirited aerial battle between a merlin and a ferruginous hawk. The merlin uttered sharp, petulant "ki-e-e-e-e-, ki-e-e-e-e" calls, repeatedly rising above the hawk and then striking down on it with audible thumps. The silent ferruginous hawk usually thwarted the merlin's attack by turning on its back and striking upward. They fought back and forth over the same ground for five minutes or more, each trying unsuccessfully to gain the advantage. Then, after discovering our presence, the battle ended and they flew off in different directions.

Clearly then, when people ask, as they do of many wild rivers, "What value does it have?"—answers cannot be given in terms of money.

At this writing, a final management plan has been released by the Bureau of Land Management for the upper Missouri Wild and Scenic River. The goal: to provide Congress with a detailed management plan that would strike a delicate balance between maximum river recreation and minimum damage. The plan calls for the upper 52 miles, which flows through agricultural lands east of Fort Benton, to be managed for recreational purposes. Most of the remaining 97 miles would be managed for wild or scenic purposes, although a seven-mile section near the mouth of the Judith River also would be designated as recreational.

Under federal mandate, wild portions of a river are those inaccessible by land and essentially of wilderness character, with few, if any, evidences of human activity. They are managed to preserve that wild character. Recreational stretches often are characterized by farms and roads, but retain a rural or pastoral character. Scenic portions fall somewhere in between, but generally are wild in character, with only a few farms or road accesses.

Part of the plan includes a carrying capacity (the maximum number of floaters a wild river can carry and still provide a primitive recreational experience), a limitation on floater use and a rest-rotation system of campsite use.

Visitor permits and quotas? The proposal disturbed me. Not from the viewpoint that it isn't necessary, but rather because I found it difficult to accept, because only a decade ago a handful of floaters used the river. It was a rare sight then to see another group of recreationists.

But things change faster than some of us would like. In 1966, it was possible to view the scattered remains of bison bones on top of Hole-in-the-Wall. Not so today—human scavengers have removed all traces of the bison.

This summer, more people will line up to float the upper Missouri Wild and Scenic River. And more are coming. Despite its apparent hardiness, the breaks ecology is fragile. Overuse and ignorance, as well as malice, can damage it severely.

For some, a compromise on the upper Missouri is unthinkable. I think of the trip a few years ago when LaFrantz's houseboat passed a flotilla of canoes carrying a group of New Englanders. When I came into contact with the group a short time later, a strikingly beautiful woman sporting a fiery red bandanna around her neck vehemently told me that "African Queens" such as LaFrantz's houseboat—and for that matter all power-driven craft—had no business on such a majestic stretch of the Missouri. Perhaps so; yet, one must spend a little time on the Missouri before making such a final decision. Like it or not, compromises can and must be made.

Perhaps the one statement that should be emphasized about the Missouri River Breaks is that *the single factor influencing the continued existence of the area is man*. If man can observe and learn from the river, he will understand the true value of wilderness. For the Missouri is a living thing, always changing from season to season and year to year. And it is precisely this organic aspect of the river that makes it a curiously comforting and hopeful phenomenon. For where there is change, there is hope—not only for rivers but for men as well.

Pipeline Breaks:

Oil and Wildlife Don't Mix

by Ken Knudson

ON MAY 17, 1978 a rock slide triggered by heavy rains and the flooding waters of Silvertip Creek ruptured a six-inch-diameter pipeline carrying crude oil from the Elk Basin oil field near Belfry to a refinery in Billings. Before the line could be repaired and clean-up procedures completed, over 60,000 gallons of crude oil had contaminated the Clark's Fork of the Yellowstone and the mainstem Yellowstone. (Another 60,000 gallons was contained in Silvertip Creek.) Earlier that same spring, an eight-inch-diameter pipeline broke near Great Falls. Due to bad weather, it took crews from the Continental Pipeline Company nearly 12 hours to locate the break. The result? Enough oil spilled to be noticeable for more than three days along nearly 40 miles of Belt Creek and the Missouri River.

In addition to those listed above, Montana streams that were polluted as a result of petroleum-related pipeline breaks in 1978 included the Two Medicine River, Cut Bank Creek, the Musselshell River, Box Elder Creek, the Clark Fork of the Columbia River and Lake Creek, which flows into the Benton Lake National Wildlife Refuge. In the latter incident, approximately 1,000 gallons of crude oil was removed from the creek at the refuge boundary just before it would have reached critical waterfowl habitat. During 1978 alone, 20 pipeline breaks occurred in Montana, and in 11 of these incidents, oil or other petroleum-related products reached state waters.

The impacts of petroleum products on aquatic life, including mammals and waterfowl, are substantial and well-documented; the most obvious is the direct coating of oil on fur, feathers or gills. Since animals rarely abandon an area in which oil has been spilled, they often continue to accumulate it on external surfaces. Once a bird, mammal or fish is covered, unless the oil is removed (and this usually requires help from humans), death results.

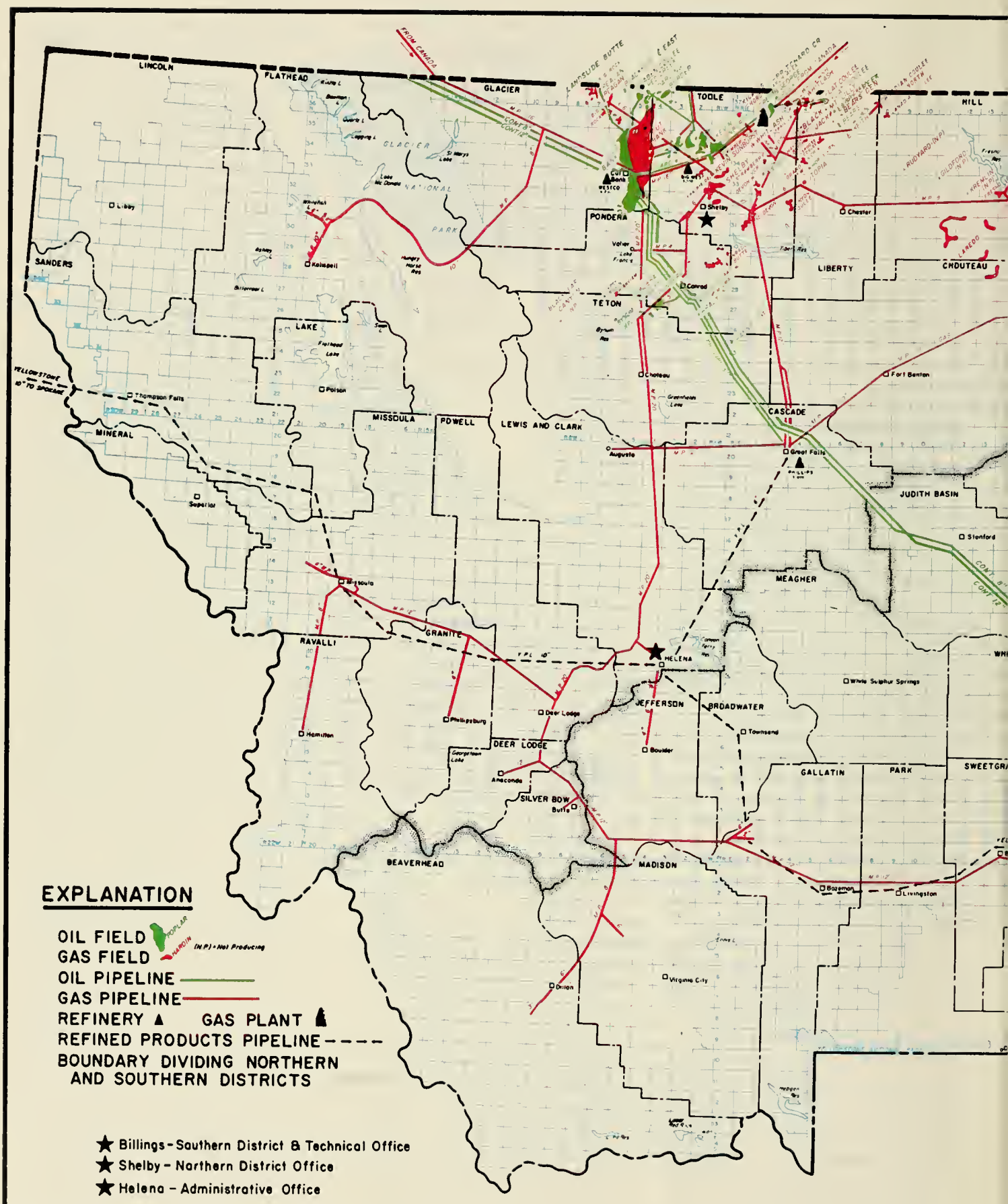
Less obvious, but potentially just as dangerous, are the indirect impacts of oil on fish and associated underwater life—animals which must be continuously surrounded by water for their survival. These animals depend on water of high quality—that is, water with very few dissolved impurities. Certain portions of oil and gas *are* water-soluble, and the resulting deterioration of water quality may be as harmful as the more conspicuous black film along the shoreline.

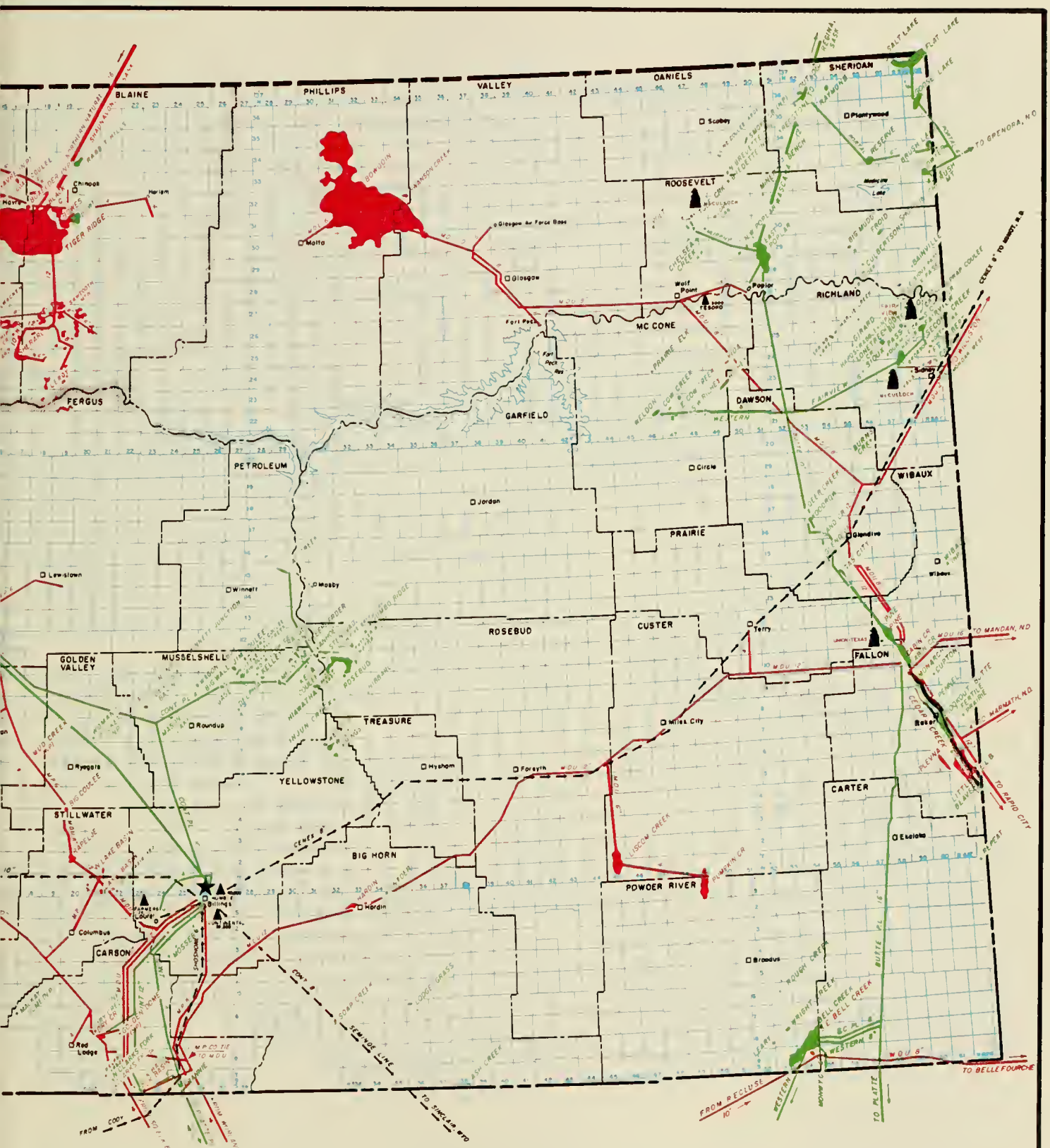
Although some have argued that no "significant" damage to Montana fish or wildlife has ever occurred as a result of a pipeline break, several considerations can temper such a statement. First, because of the vastness of the state and the often-remote location of breaks, people assigned to evaluate impacts often arrive some time after the fact—at times, even after cleanup has begun. Second, because pipeline breaks are often associated with floods, it is sometimes impossible for biologists to conduct the necessary in-stream evaluations. Finally, even if an evaluation can be made, unless very recent and accurate "before spill" data concerning fish and wildlife populations on or near the stream are available, no truly accurate "after spill" assessment can be made. Imagine how many biologists would be needed to collect such data seasonally, or even annually, for the thousands of streams in Montana.

If it is necessary to actually observe dead or dying fish, birds or mammals for several miles below a break, we have little hard evidence of pipeline spill impacts in Montana. However, in view of the visible and invisible effects of oil discussed earlier, we can be sure that the impacts on fish and wildlife were considerable from the over 125,000 gallons of petroleum products that entered state waters from pipeline breaks during 1978.

Who responds to pipeline breaks and what actions are taken to protect both human and animal life? Once a pipeline break is discovered, one of several agencies is normally contacted, depending on the caller (it could be you). Calls are frequently received by the Highway Patrol and the departments of Military Affairs, Health and Environmental Sciences, Fish and Game and Highways. In some cases, the responsible oil company is contacted (if known). Once one of these agencies has been notified, a telephone network between all of the aforementioned and in some cases, the departments of Agriculture, Community Affairs and Justice, is activated. Each agency is charged with certain responsibilities, depending on its area of expertise. The U.S. Environmental Protection Agency is normally also contacted and may send personnel to the scene if the spill is large enough.

The responsible oil company, of course, is liable for repairing the break, containing the oil spill and cleaning up the area. In some cases, oil spill cooperatives, which have been formed between certain oil companies, may assist in containment, as may several of the previously


LINCOLN
FLATHEAD
GLACIER
TOOLE
HILL
SANDERS
LAKE
MINERAL
MISSOULA
POWELL
LEWIS AND CLARK
PONDERA
LIBERTY
CHOUTEAU
TETON
CASCADE
JUDITH BASIN
MEAGHER
RAVALLI
GRANITE
JEFFERSON
BROADWATER
DEER LODGE
SILVER BOW
BEAVERHEAD
MADISON
GALLATIN
PARK
SWEETGRASS
EXPLANATION
OIL FIELD
GAS FIELD
(N.P.) = Not Producing
OIL PIPELINE
GAS PIPELINE
REFINERY
GAS PLANT
REFINED PRODUCTS PIPELINE
BOUNDARY DIVIDING NORTHERN AND SOUTHERN DISTRICTS
Billings - Southern District & Technical Office
Shelby - Northern District Office
Helena - Administrative Office



Montana
Oil and Gas Fields, Pipelines and Refineries
1976

Board of Oil and Gas Conservation

Pipeline Breaks in Montana — 1978

Date	Entity responsible	Location (county, nearest town)	Stream(s) impacted	Amount and type	Cause	Other information
8-9-78	Husky Oil	Carbon County Big Sandy Coulee	Clark's Fork of the Yellowstone	10 BBLS crude		Oil still present on banks one week later
7-12-78	Texas Pipeline Co.	Glacier County Cut Bank Tank Farm	None	100 BBLS crude	External corrosion of gathering line	
6-16-78	Texas Pipeline Co.	Glacier County Big Rock Coulee	Big Rock Coulee Cut Bank Creek	More than 10 BBLS	Corrosion in 3-inch crude line	
6-6-78	Cenex	Yellowstone County 2 miles from Huntley	None	525 BBLS diesel	Contractor cut line	Diked before reaching surface water
6-8-78	Texas Pipeline Co.	Glacier County Dry Coulee	None	40 BBLS crude	Corrosion in 3-inch crude line	
6-1-78	Phillips Petroleum Co.	Cascade County Benton Lake National Wildlife Refuge	Lake Creek	20 BBLS crude	External corrosion of crude line	Rain washed the oil into Benton Lake
4-10-78	Yellowstone Pipeline Co.	Powell County	Unnamed spring-fed stream	2 BBLS	Bulldozer cut line	Rain washed it into stream
5-17-78	Marathon Pipeline Co.	Carbon County Silvertip Creek	Silvertip Creek, Clark's Fork and mainstem Yellowstone	3,000 BBLS crude	Rock slide broke 6-inch crude line	3,000 BBLS lost, but 1,500 BBLS recovered
5-3-78	Texaco	Rosebud County	None	35 BBLS crude	Coupling broke on 3-inch line	
4-18-78	Western Oil Transportation Co. and Miami Oil	Glacier County Two Medicine River	Two Medicine River	500 BBLS crude	Corrosion and extremely cold weather	40 miles of stream impacted
4-12-78	Phillips Petroleum Co.	Glacier County	Rocky Coulee Creek	2 BBLS crude	Extremely cold weather split line	Line split at creek crossing
3-28-78	Texas Pipeline Co.	Toole County	None	400 BBLS crude	Corrosion of 6-inch trunk line	Snow and mud slowed cleanup
3-27-78	Continental Pipeline Co.	Petroleum County	Box Elder Creek Musselshell River	20 BBLS crude	Flood washed out line	
3-22-78	Continental Pipeline Co.	Musselshell County	Musselshell River	50-75 BBLS condensate	Bank cave-in broke 4-inch crude line	
3-17-78	Continental Pipeline Co.	Cascade County	Belt Creek Missouri River	(700 BBLS?) condensate	Break in 8-inch pipeline	Oil could be seen on Missouri for 3 days
2-27-78	Westco Pipeline Co.	McCone County	None	30 BBLS	Bulldozer hit line	
2-22-78	Cenex	Petroleum County	Musselshell River	(10 BBLS?) crude	Bulldozer hit 4-inch gravity line	Oil spilled onto frozen Musselshell
2-22-78	Texas Pipeline Co.	Toole County	None	160 BBLS crude	Corrosion of 8-inch trunk line	50 BBLS not recovered
3-31-78	Shell Oil	Fallon County Pennell Field	None	20 BBLS crude	Broken line	Break went over 3 months unnoticed
1-13-78	Texas Pipeline Co.	Toole County	None	15 BBLS crude	Split in gathering line	

NOTE: BBL = barrel; 1 BBL = 42 gallons (from Department of Health and Environmental Sciences, Water Quality Bureau, files)

mentioned state or federal agencies. It is interesting to note that none of the agencies listed above is responsible for assignment of fines and penalties for impacts to the environment resulting from pipeline breaks. This phase of enforcement is handled by the U.S. Coast Guard.

Although this communication network between agencies, known formally as the "Hazardous Material Response Plan," is a seemingly suitable strategy for notification and response, the actual on-site arrivals of members of any agency may be delayed by several hours or even days. This is certainly not an intentional stall by anyone involved, but rather a function of communication delays, incorrect information or the remote location of the break.

The actual containment of the spill may also be delayed by inadequate equipment or insufficient manpower initially arriving at the scene. Inclement weather naturally aggravates all of the above problems. The final outcome is that if a pipeline breaks near a stream, normally over half the quantity of spilled oil finds its way into the stream. If the break is actually within the stream, recovery of the oil is even more difficult and the percentage of oil polluting the stream dramatically increases.

Where are the oil pipelines in Montana? The map accompanying this article shows the major lines in Montana as of 1976. Nearly all of these pipelines, which form a network between wells, refineries and marketing points, are underground. Once buried, pipelines are relatively unserviceable (you can't paint or repair cracks in them as easily as you might, say, repair the outside of your house when it starts to show signs of wear). They are also relatively unnoticeable once the vegetation above them has re-established—until a break reveals a pipeline's hidden path.

As a matter of convenience, pipelines often closely follow streams and rivers. In Montana's narrow mountain valleys, there is little escape from rugged terrain except along stream channels. It is not surprising, then, that floods, bank cutting and other water-related influences often play a part in pipeline breaks.

Because pipelines usually follow the path of least resistance as far as terrain is concerned, their routes often lead through remote areas. This isolation, coupled with the fact that Montana is so vast and sparsely populated, results in breaks often going undetected for some time. For example, although there were at least two separate pipeline breaks involved in the 1978 oil spill into the Two Medicine River, they went unnoticed for over two days. These breaks were aggravated by rapid thawing after a prolonged freeze, flooding and, as stated by the two companies involved, "corrosion of the pipelines." In another situation, petroleum products were still seeping into an unnamed tributary of the Clark Fork of the Columbia River nearly five weeks after the discovery and repair of the break. Apparently much of the oil had soaked into the snow and soil and only began seeping into surface waters when warmer weather arrived.

Corrosion is a constant nemesis of anything man makes. Add to this physical law the unpredictable influences of nature and the words of a popular song by Paul Simon—"everything put together sooner or later comes apart"—and we can be sure that pipeline breaks are going to occur somewhere, sometime.

What can be done to reduce the frequency, particularly in areas near streams or lakes? As a preventive measure, rigorous pressure testing of all lines located near streams or lakes should routinely be conducted. In this process, dye is placed in a section of pipeline near the watercourse and the pressure within the line is increased to several times that normally utilized to transport the oil. If leaks are detected, the line should be repaired or replaced. Pipeline routes should also be inspected periodically to ensure that bank cutting by streams is not threatening to expose the line to weather or flood waters. As normal operating procedure, sections of pipeline should be replaced when they are approaching the end of their usable age.

A final consideration is most important, because it would alleviate the need for most of the preventive measures just listed and greatly reduce the impacts to fish and wildlife. Simply stated: Underwater pipeline crossings of perennial streams should be eliminated; it is at such stream crossings that pipeline breaks can cause the greatest damage to fish and wildlife in the shortest period. If a pipeline cannot be routed away from such watercourses, and stream crossings must therefore be made, the pipeline should be placed on above-water structures, where detection of breaks and subsequent repairs can be more readily accomplished, regardless of weather conditions.

Another recent example emphasizes this point: This past winter, a 24-inch-diameter pipeline carrying sewage within the city of Great Falls ruptured near midstream in the Missouri River. This pressurized line had the capacity to transport up to 25 million gallons of liquid per day. If its contents had been oil rather than sewage, the impact to the river would have been much more significant. It should be noted that because of snow, freezing temperatures and ice packs within the river, attempts at repairing this underwater pipeline were delayed for several months. Furthermore, due to winter conditions and detection limits of meters used to monitor the flow within the line, the break went unnoticed for over a week!

Proper inspection, testing *and* location of future pipelines can help reduce, if not eliminate, the unnecessary and harmful impacts to our natural resources caused by pipeline breaks.

Because of the potential for serious environmental degradation to fish and wildlife habitat, not to mention the potential for contamination of agricultural, domestic and other beneficial uses of water in Montana, careful and thorough planning of pipeline routes must be conducted to ensure that surface water crossings are reduced to an absolute minimum and that fragile ground water and wetland zones are avoided. In view of the impacts of pipeline breaks discussed in this article, such planning should be considered necessary, logical and in the best interest of Montana's natural resources. ■

Oil and Wildlife Don't Mix
see page 37